AMERICA BUILDING WORLD'S LARGEST MOTORSHIPS

NEW YORK SEATTLE

# MOTORSHIP

*Devoted to Commercial and Naval Motor Vessels*

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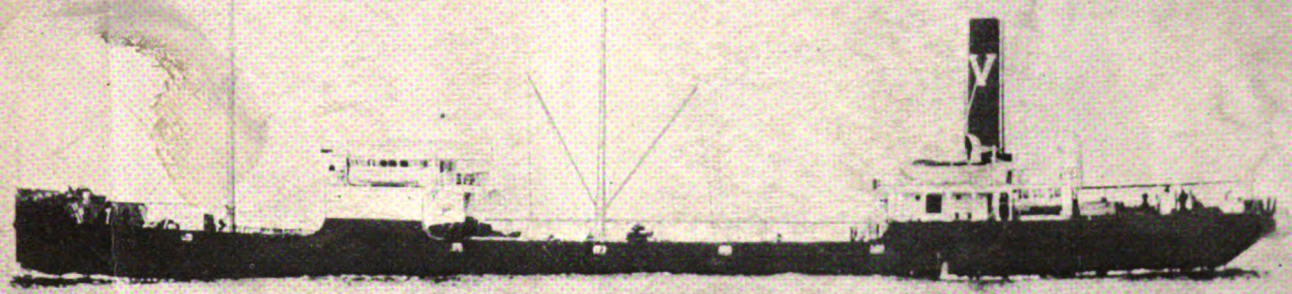

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*EXCLUSIVE motorship-operating and technical articles by the world's foremost writers on marine engineering appear in every issue.*

MOTORSHIP

(Trade Mark Registered)

*PROFUSELY illustrated with photographic reproductions of the newest designs in international merchant motorship construction.*

Vol. V | New York, U. S. A., November, 1920 | No. 11

# America Building World's Largest Motorships

*Fleet of Four 20,000 Tons D.W.C. Diesel-Driven Ore Carriers For Bethlehem Steel Company*

WHAT constitutes the greatest impetus yet given to the motorship movement in the United States is the ordering by the Bethlehem Steel Company of a fleet of four Diesel-driven ore-carriers of 20,000 tons deadweight capacity each. These vessels, for financing which $20,000,000 in bonds were recently issued by the Company, are to be propelled by the new Bethlehem-West two-cycle type, single-acting Diesel-engine, which, as recently announced by Mr. Chas. M. Schwab, has shown itself to be very successful in their new single-screw 11,500 tons d.w.c. motor ore-carrier "Cubore," that was first illustrated in "Motorship" of August last.

These new motorships will be of between 28,000 and 30,000 tons loaded displacement each, and will be twin-screw. The propelling mechanism in each case consisting of twin 3,200 i.h.p. (2,300 s.h.p.) six-cylinder engines 25½ in. dia. by 48 in. stroke, turning at 105 r.p.m., giving the vessel a speed of 11½ knots. With minor modification these engines will be the same as the one installed in the "Cubore." The engine, we understand, while moderately rated at 2,300 shaft h.p. produced as high as 3,000 shaft h.p. on trials. so these new vessels in addition to being the largest motorships on order anywhere in the world, will be quite important as regards motive power, and will rank next but one in size to the 4,000 shaft h.p. two-cycle Diesel engines building for trans-Atlantic liners at the Ansaldo San Giorgio works in Italy, of which the first pair is on the way towards completion. The fleet of British 6,600 i.h.p. Glen Line motorships have eight cylinder engines, so their cylinder output is less than the Bethlehem engine. But the single-screw engines of the four Doxford motorships are of higher cylinder power.

The hulls of the four new American motorships will be built by the Bethlehem Shipbuilding Company, and we presume that they will be operated by the Ore Steamship Company of New York, as is the "Cubore." Mr. Schwab is very enthusiastic over the new Diesel engine, which he believes is a marked advance on anything yet built. This is challenged by Sir Trevor Dawson of Vickers, Ltd., on another page in this issue.

Undoubtedly this fleet of five motorships (we include the "Cubore"), will enable huge transportation economies to be effected. The vessels will trade between the Company's ore-mines in Chili, S. A., and Sparrows Point, Bethlehem, and Steelton, U. S. A., as the mining and loading facilities in South America are all ready, so plans to develop the properties will proceed. At present the Bethlehem Steel Co. are paying $5 per ton freightage on 50% iron from Lake Superior in addition to the cost of the ore, whereas the motorships will enable the Chilean ore to be carried here at less cost and it contains 67% iron. The $20,000,000 fifteen-year 7% bonds were oversubscribed by more than two and a half times, this being the largest sum that American financiers and bankers have yet invested in Diesel-driven motorships.

# Coal-Burning to Oil-Fired Boilers

*A Wholesale Change That May Ultimately Prove to Be a Grave Error*

OWING to the current high-cost and shortage of fuel-oil at seaports, the conversion of steamers from coal-burning to oil-firing under their boilers has not resulted in all the advantages anticipated by shipowners. In some quarters there already are regrets that the change was made. Practically no worth-while saving in bunker-bills is made to-day, and owing to the average steamship having to carry enough oil for a round-voyage, her weight cargo-capacity is generally less than it was before, because the double supply of fuel is heavier, even if more compact, thus reducing the earning powers of the ship. True, there is about 8% to 10% cubic cargo-capacity gain by changing the position of the fuel from the bunkers to the double-bottom. But, a coal-burning steamer generally bunkers at each end and consequently only has to carry fuel for a one-way voyage. So there is a loss in weight capacity thro' using oil-fuel. Moreover, many steamers have been delayed in port awaiting oil, while others have even bunkered more expensive Diesel-oil. Is it surprising that one occasionally hears of shipowners again turning to coal with its inconveniences and drawbacks?

How vastly different would be the result were coal-burning ships converted directly to economical internal-combustion oil-engine power, as has been done with half a dozen large European freighters. The fuel-consumption would be reduced by almost four-fifths and would have prevented an oil-shortage—an enormous reduction almost unbelievable, but proven in actual practice, as in the case of the Norwegian ships "Songvar," "Songdal" and "Songvond" regularly trading between the U. S. A. and Christiania. At least one of these three converted coal-burning steamers, now Diesel-driven motorships, can nearly always be seen loading at a New York dock by interested shipowners. Although these vessels are over 20 years old, S. O. Stray & Co. of New York quite recently paid the Norwegian Government $240 per d.w. ton for them when the current price of steamers was under $200 per ton.

If American coal-burning steamers were thus converted, fuel for a lengthy round-voyage could be carried without encroaching whatever upon the cargo space, whereas, the bunkers at present occupy valuable space in the hulls. In fact, there would be a very big gain in both cubic and weight cargo-capacity, giving a benefit in earning power no matter what class of cargo was being carried, even if it differed so widely as cotton and machinery. This gain would be about 12% in weight-capacity and about 20% in cubic-capacity, the exact percentage depending upon the type of Diesel engine and design of ship.

Furthermore, there would be a complete elimination of the stokehold crew, and an absence of all steam-pipes on deck or below, while no boiler-water would have to be carried. Cargo could be stowed in the space now occupied by the boiler-water-tanks and coal-bunkers, as well as in the part of the boiler-room space that would be saved. The very small quantity of fuel-oil necessary (300 to 400 tons for a 11-knot 10,000 tons d.w. vessel on an 8,000 miles voyage) could be carried in the double-bottom under the engine-room, so only part of the hull need be altered structurally to carry fuel-oil. Incidentally, this would save rapid deterioration of the hull frames and plating which occurs under the boilers of a coal-burner.

Foresight on the part of the leading oil-companies should cause them to adopt a program of educational publicity advocating against the waste of oil under ships' boilers, and urge the economical use of liquid-fuel in internal-combustion oil-engines and incidentally avoid re-occurrence of a shortage; otherwise in a few years a drop in the price of coal (which is bound to come) may see an extensive reversion to coal for merchant-shipping with a resultant big trade-loss to the oil-companies.

However, when shipowners *fully appreciate* what enormous benefits can be obtained by converting their coal-burning and oil-fired steamers to internal-combustion oil-engine power—even at high cost and with unavoidable attendant delay—there will be an unprecedented rush upon the ship repair-plants and shipyards to have the conversional work carried out. It is merely a question of sufficient time for the light to dawn upon shipping men. For the sake of American mercantile-marine let us hope that time will not be far distant.

The Shipping Board has started a rate-war because a prominent French line is carrying freight for lower charges than American ships could carry cargo with profit. But this rate-cutting can only be maintained by the Board at enormous loss to the Nation that will be borne by the Nation. But, were America's freighters economical motorships the rate-war could have been accomplished with our ships operating at a profit, as there is a difference of 50% to 60% in operating costs in favor of this type of vessel, according to shipowners who operate both steamers and motorships.

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# New Motorship Fleet of Pacific Steam Navigation Company

## *First of Six Diesel-Driven Freighters Visits New York on Maiden Voyage Using Heavy Mexican Crude-Oil as Fuel*

WHEN an old-established British steamship line that hitherto had pinned its faith on coal-fuel takes up the motorship vigorously and seriously, and forcibly demonstrates its belief in the new power by ordering at one-go a fleet of *six* Diesel-driven vessels aggregating over 50,000 tons deadweight, then surely it is time that all American shipowners now hanging fire should with self-advantage reveal a little more boldness and shake off the nervousness which is preventing them from contracting for motorships with American yards.

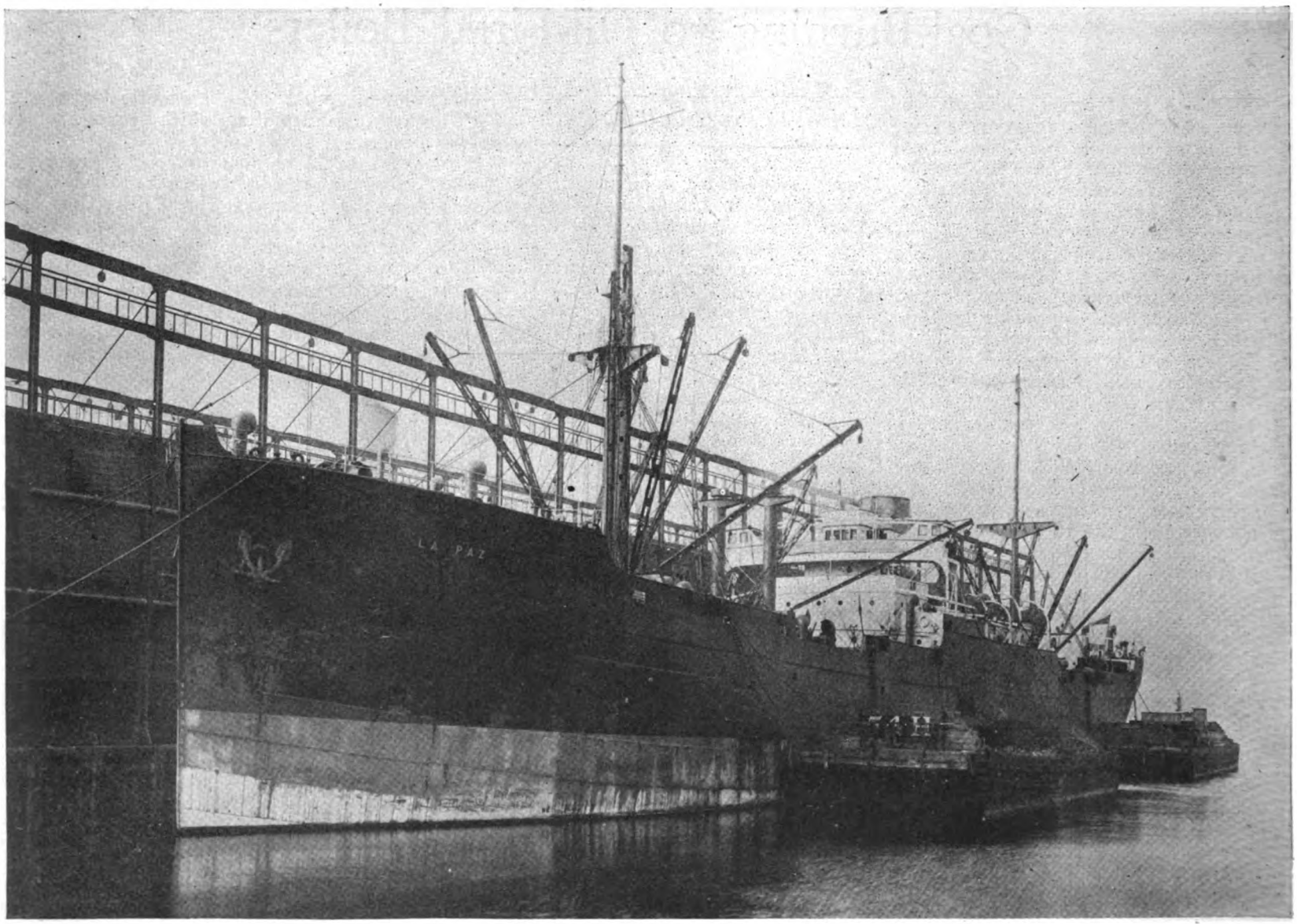
This is the case with the well-known Pacific Steam Navigation Co., Ltd., who have docks in New York, and reference to whom we have made several times in our columns as having three large motorships under construction. We will supplement this information by being the first publication to state that this British Company have a fleet of *six* motorships on order with Harland & Wolff, three of which are of 9,190 tons d.w.c. and three of larger size. Perhaps we would be more correct to say *five* more on order, because as we write the first of this new fleet is lying at Pier 42, North River, New York, having just completed her maiden voyage.

The progress that has been made in motorship development in Great Britain during the year that has elapsed since our visit to Europe is most remarkable, as we then forecasted. In our December issue we shall give a review of the present situation which will show that almost half a million tons deadweight of motorships are now on order and under construction in that country, divided between a dozen of the biggest and most powerful British shipowning companies. It is competition from these economical vessels that our own coal and oil wasting steamers will have to face—or rather will be unable to face—in the very near future. Is it any wonder that Captain E. C. Tobey (until recently head of the U. S. Shipping Board in London and now with the United American Steamship Lines) felt it very necessary to say: *"I will hammer-in motorships to everybody as hard as I can, because I am convinced in my own mind that if we fail to make provision for their building now we will suffer seriously later on"*—in a letter to us when his knowledge of what was going on and what our steamers would have to meet fully made itself apparent? That Captain Tobey returned from Europe such a strong believer in the motorship is a good thing for the American Merchant Marine, as he is now a prominent figure in the most powerful American shipping and shipbuilding organization ever formed, and whose motorships (now building) will remain on the seas long after many other U. S. *steam*ship companies have gone to the wall through not turning to economical ships soon enough.

To return to the "La Paz," which is the first of the Pacific Steam Navigation Company's new motorships to arrive here to load cargo for South America. First, we will give her general dimensions, and then make a few remarks:

| | |
|---|---|
| Displacement (loaded) | 13,600 tons |
| Dead-weight-capacity | 9,190 tons |
| Cargo Capacity (General) | 424,448 cu. ft. |
| Cargo Capacity (Special) | 462,399 cu. ft. |
| Fuel-Capacity | 839 tons |
| Fuel Used on Maiden Voyage (Glasgow to New York) | 155 tons |
| Speed (at 24ft. dft.) | 11½ knots |
| Daily Fuel-Consumption at Sea (24 hrs.) | 10¾ tons |
| Daily Fuel-Consumption in Port (12 hrs.) | ¾ tons |
| No. Engine-Room Crew | 19 |
| Total Ship's Crew (Including Officers)) | 56 |
| Shaft Horsepower | 2400 h.p. |
| Indicated Horsepower | 3200 h.p. |
| Engine-Speed | 110 R.P.M. |
| Fuel Used on Maiden Voyage, | Mexican Crude-oil of 0.91 gravity |
| Total Amount Fuel Used on Maiden Voyage, | about 155 tons |
| Length (B.P.) | 405 ft. |
| Breadth | 54 ft. |
| Draught | 27 ft. |
| Gross Register | 6800 tons |
| Auxiliary Diesel Engines | Three of 150 b.h.p. |
| Type of Auxiliaries | Electric |
| Captain | F. W. Makin |
| Chief-Engineer | W. H. Rowlinson |
| First Officer | S. C. Grant |
| Second Officer | T. R. Scott |
| Guarantee-Engineer | F. R. Martin |
| Second Engineer | H. Gray |
| Senior Electrician | W. H. Ryder |
| Passenger Capacity | 9 in 3 staterooms |

All the members of the crew to whom we spoke on the occasion of a visit to the "La




**The motorship "La Paz" of the Pacific Steam Navigation Line. She is the first of six Diesel-driven vessels building for this company.**

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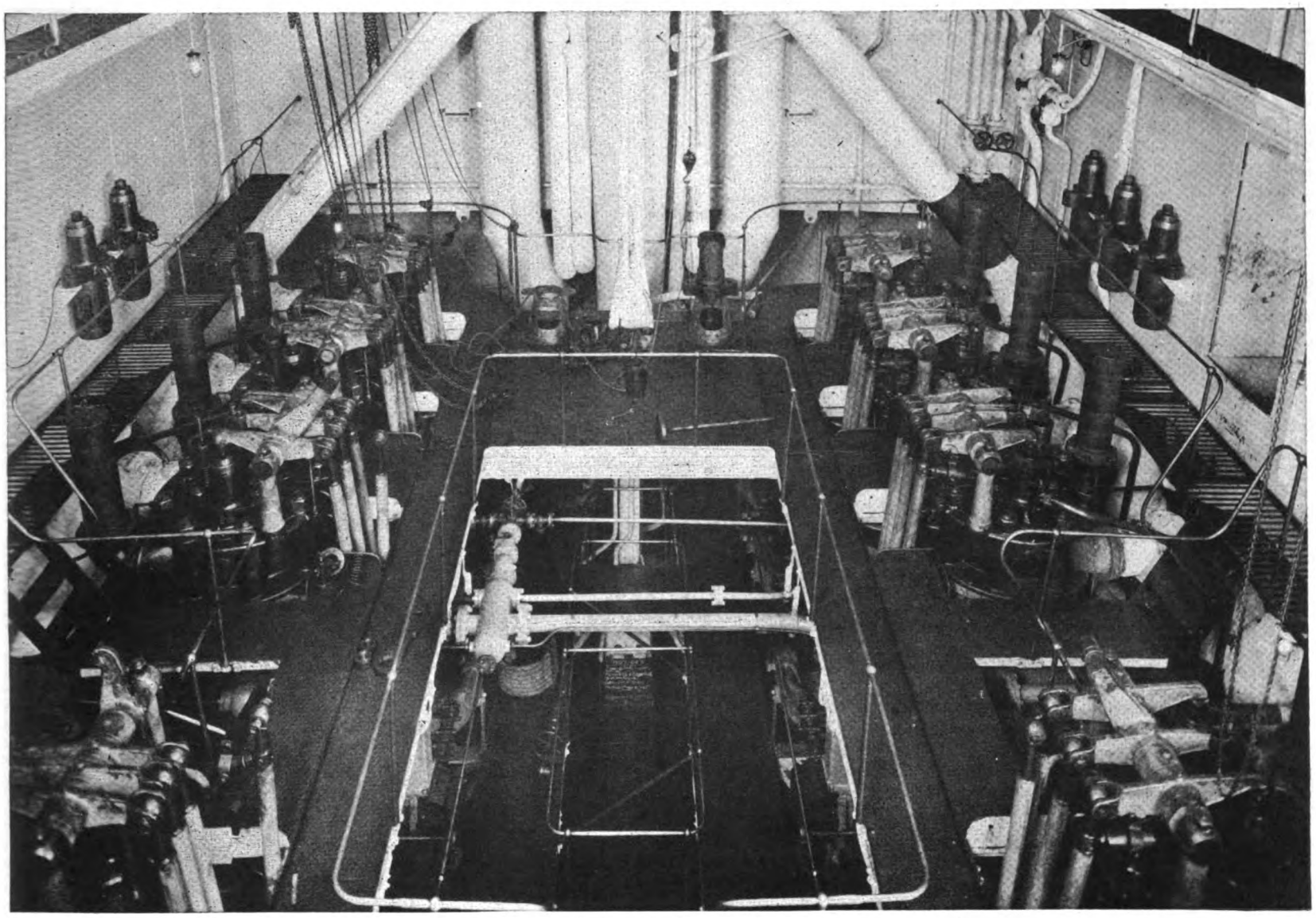


M. S. "La Paz." View of engine-room looking forward.

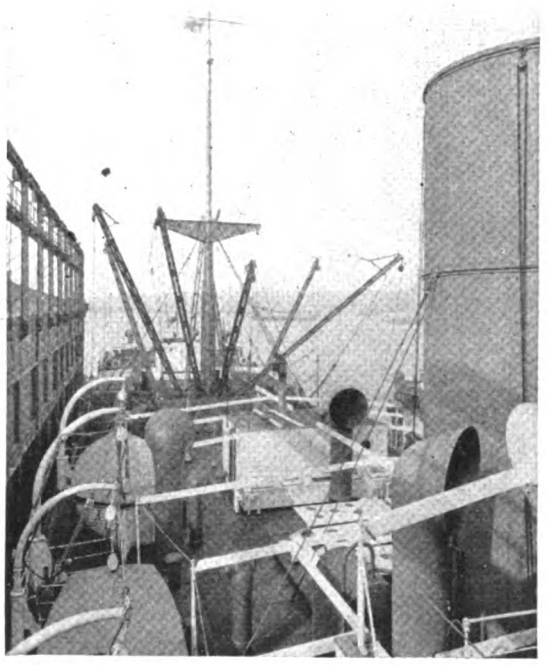
Paz" while she was lying at her pier in the Hudson, said that very bad weather was experienced on the way over, except for the last two days when the sea quieted down. There is no need to say that the Diesel-engines of this ship showed the accustomed reliability en route to America on this maiden voyage, as facts speak louder than words. It is sufficient to say that although she was almost solely in ballast she only took 13 days 7 hours from Glasgow to New York. About 1,000 tons of cargo was in her hold. Incidentally we will mention that her Chief-Engineer is a steamman and has never been to sea in a motorship before, so everything is new to him.

On one day she covered 257 nautical miles, and on another she made 282 miles, the latter representing an average for that day of 11.75 knots. This latter was attained with the twin Diesel-engines averaging 1545 i.h.p. and 1534 i.h.p., respectively, at 108 r.p.m. The average speed of both engines for the voyage was 107.7 r.p.m. Later on we expect this speed and power will be bettered, particularly in good weather with the ship loaded, as each engine is rated at 1600 i.h.p. at 110 r.p.m. She had a very short trial-trip, so her engines are not yet properly run up to full time.

Too much pressure cannot be placed upon the fact that she used Mexican crude-oil of 0.91 gravity on this voyage. As a matter of fact, she loaded 802 tons of this fuel in Glasgow before her start, but only used about 155 tons of this amount en route. As no trouble developed (as shown by the average speed maintained) this will form an answer to all those who maintain that Diesel-engines will only run successfully on light residual-oils.

The entire job of constructing the ship and machinery is a credit to her builders; namely, Harland & Wolff, who constructed her Diesel-engines under Burmeister & Wain license at Glasgow. In the engine-room the lay-out of the equipment is excellent and is far superior to some of the earlier British motorships that we have seen, and is an indication of the progress now being made across the Atlantic.

Yet the main engines themselves are of an old design with separately cast-cylinders, and not the *three-cylinder en-bloc* arrangement with cast-iron cylinder beams and through steel bolts, as in the very latest B. & W. design now being followed at the Harland & Wolff shops and in the works of Cramps, the U. S. licensee. We presume that the castings of these engines were made before the newer design was thoroughly tried out, or else the owners preferred the older design which had been through a good period of test at sea, but does not provide quite such an accessible engine.



M. S. "La Paz." Deck looking aft, showing steel cargo booms working after holds.

However, there is one new feature, namely the installation of electric-operation of the reversing-mechanism in place of the old pneumatic-motor, which moved the cam-shaft, lay-shaft, and valve push-rods. The motor operating the reversing-mechanism is of 7 b.h.p. and the design appears to give thorough satisfaction, reversing from full-ahead to full-astern taking only about 5 seconds.

Aspinal governors are fitted to both engines; but, regardless of the ship being light and the very rough seas experienced, at no time did the engines show more than a 5% increase in speed over the rated revolutions of 110 r.p.m., so racing was conspicuous by its absence. This is one of the excellent features of a modern motorship that enables a better average speed to be maintained during the year than is possible with the slower running propellers of a steamship of similar power and size, and which make the old propeller-efficiency theory a fallacy in practice.

Each main engine has six cylinders 26.378″ bore by 39.370″ piston stroke, and develops 1,600 i.h.p. (1,200 shaft h.p.) at 110 r.p.m. on the single-acting four-cycle principle. They drive twin-screws through Michell thrust-bearings. The engine-room occupies about 24 frame-spaces amidships and the exhaust-gases are carried up a short but large diameter stack, which is perhaps unfortunate, as outwardly there is nothing to distinguish this vessel from

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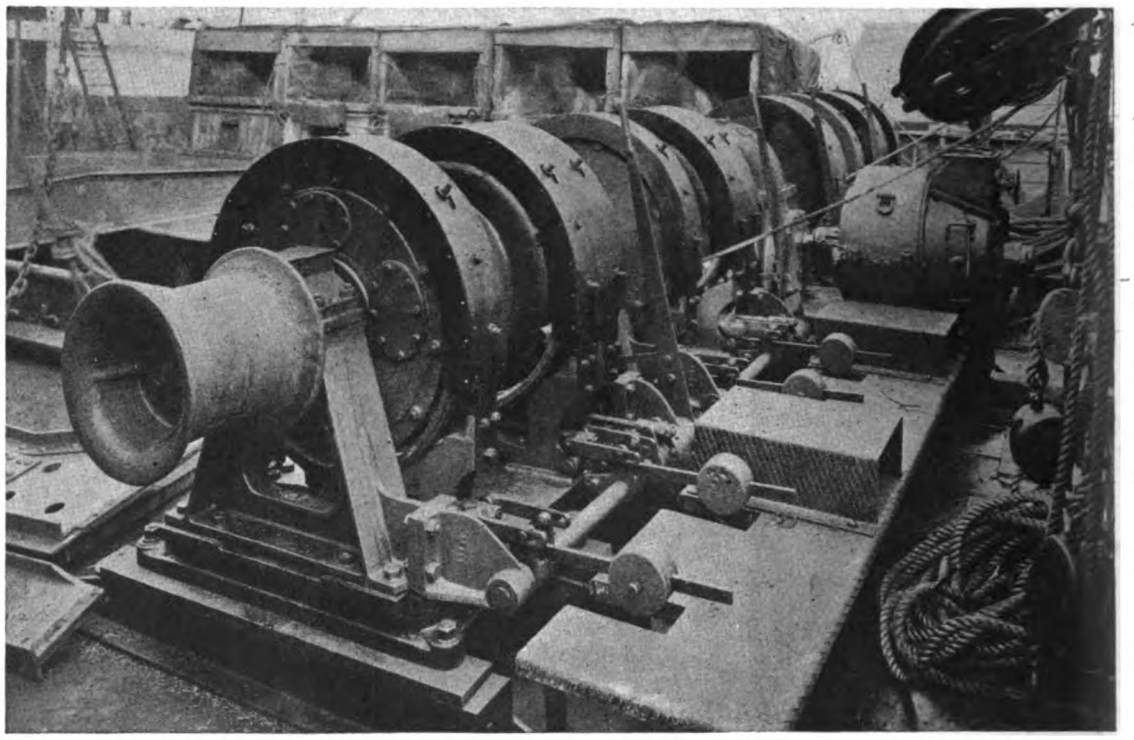
a common or garden pattern every-day steamer, whereas a motorship is a distinctive craft and so should have the distinctive feature of "no funnel." Generally the result of eliminating the stack is a much smarter boat and gives an air of grace often absent with a steam freighter.

Between the two main engines at the after end are two large fuel-oil filters, which strain all the fuel after it leaves the settling-tank and before it is taken by the fuel-injection pumps and blasted into the engine cylinders. We also noticed a large De Laval separator for the lubricating-oil. It is of 600 gallons per day capacity and is electrically driven.

On the starboard side of the engine-room are arranged three triple-cylinder four-cycle Burmeister & Wain type auxiliary Diesel-engines of 150 b.h.p. each, direct-coupled to 100 k.w. 220 volt electric generators and turn at 300 r.p.m. One of these is used at sea, two in port, and one as a stand-by for emergencies. The electric-generators were built by W. H. Allen & Co., of Bedford, England, and the Diesel-engines by Harland & Wolff, Ltd.

Sufficient electric current is generated for the following engine-room and deck auxiliary machinery:

(A) Electric-driven twin-plunge ballast-pumps. Makers J. H. Carruthers & Co., Glasgow, Scotland.
(B) Three electric-driven lubricating-oil pumps (One for cold weather, two for hot-weather and one spare pump).
(C) Two 90 b.h.p. electric-driven B. & W. type air-compressors for manoeuvring purposes, etc.
(D) Two electric-driven engine cooling-water circulating and ship's sanitary turbo-pumps. Makers Rees & Co., Wolverhampton, England.



M. S. "La Paz." The big McFarlane five-drum electric-winch showing its single 50 b.h.p. electric-motor.

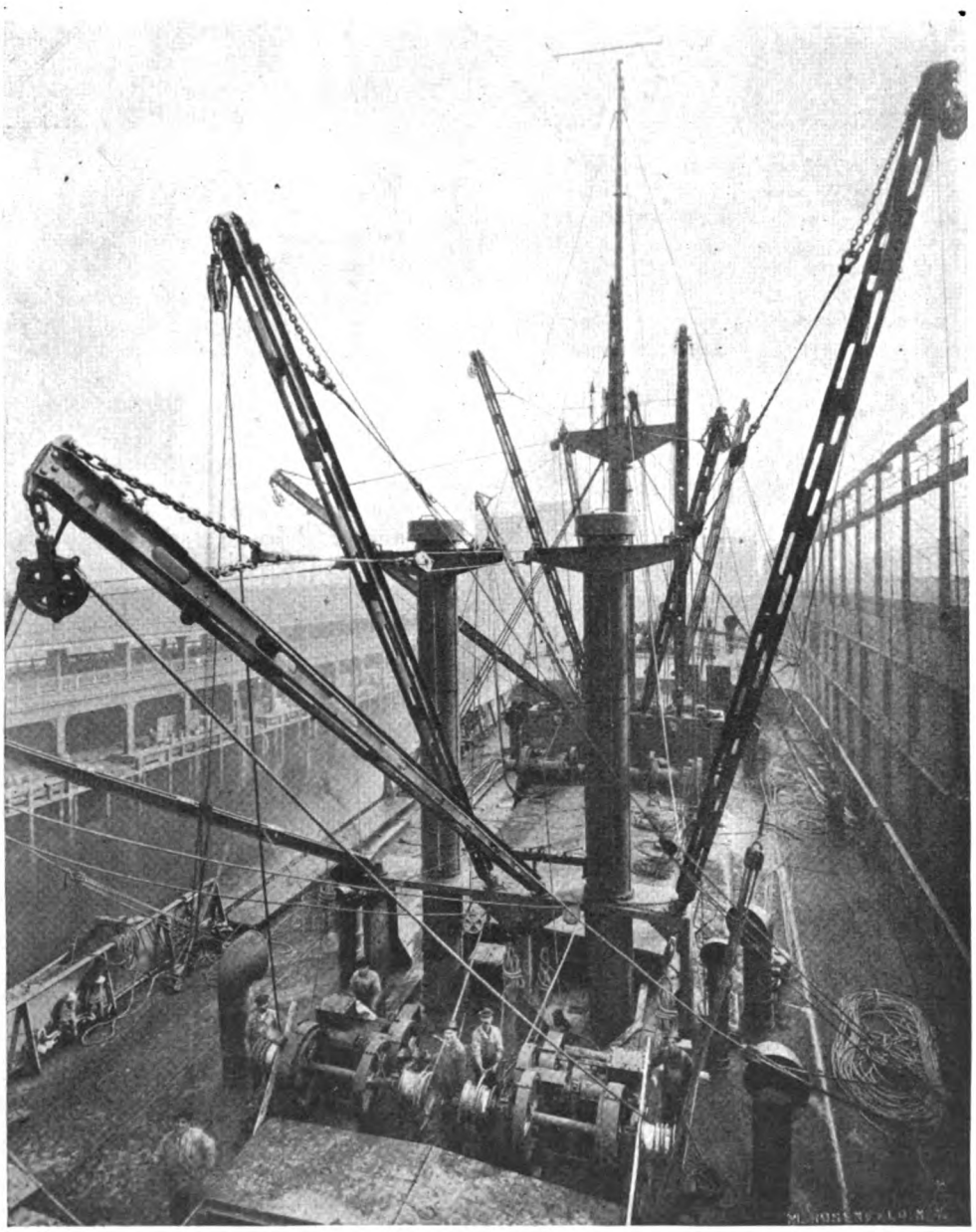
(E) Two electric-driven piston-cooling fresh-water pumps.
(F) One electric-driven ship's fresh water pump.
(G) Two electric-motors for turning-over main Diesel engines in port.
(H) One electric-driven 600 gallon De Laval oil-separator.
(I) One Scott electric-motor driven refrigerator set. Makers J. E. Hall & Co., Dartford, England.
(J) One electric-driven rotary fuel-oil pump for pumping oil from bunkers to settling tank. Flexible coupling between motor and pump.
(K) One electric-driven blower in connection with engine-room steam-heating system.
(L) Two 7 b.h.p. electric motors for operating reversing mechanism on main engines.
(M) Ten electric winches (one of 50 b.h.p.) Makers Lawrence Scott & Co., Norwich, England.
(N) One electric steering-gear. Makers Lawrence Scott & Co., Norwich, England.
(O) One electric-anchor windlass.
(P) Electric fans, lights, etc., throughout ship.

So it will be seen that the electrical installation of the ship is very complete and the foregoing list indicates how important electric equipment has become to the modern motorship, it forming a valuable part of the vessel.

Lloyds rules stipulate that a small steam-driven emergency air-compressor shall be installed. Consequently it has been necessary to equip the engine-room with a small donkey-boiler, which is also used for steam heating. As yet this boiler has not been used. It is a Cochran vertical-boiler operating at 100 lbs. pressure and is oil-fired, but we see no substantial reason why the exhaust-gases from the main engine could not have been used to fire this boiler in the winter time when the vessel is at sea and then use the oil-burner in port. At the after end of the engine-room is a steam heater made by the Standard Engineering Co. of Leicester, England, which seems somewhat of a novelty to us. An electric-blower attached to the same distributes the heat.

On deck very complete arrangements have been made for handling the cargo, one of the derricks having a lifting capacity of 40 tons. Altogether there are 10 electric-winches, all of the Scott type with one exception; namely, a new design of McFarland electric-winch of 50 b.h.p. with four 6 ft. 4 in. drums operated by one motor. This winch is capable of lifting three tons at 310 ft. per minute, or heavier weights at slower speed, and is worthy of a special description, which we hope to give at a later date. This article has been written after a very brief inspection of this ship on the eve of going to press, so we have had no time to go deeply into details regarding many other interesting features of this ship.

Lastly, we will mention that the engine-room crew consists of Chief-Engineer, First, Second, Third and Fourth Engineers, two Fifth Engineers and two Sixth Engineers, three electricians and eight oilers and wipers.



M. S. "La Paz." Deck looking forward from the bridge, showing excellent cargo-handling facilities. The 40-ton derrick can be seen hauled-up tight to the fore-mast.

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M. S. "La Paz" officers, engineers and cadets. Captain Makin can be seen in center with Chief-Engineer Rowlinson on his right

# Dawson Versus Schwab

## *Sir Trevor Dawson's Answer to Mr. Chas. Schwab's Claim*

AFTER having pointed out the wisdom of adopting Diesel engines for all vessels now being built, Sir Trevor Dawson, Vice-Chairman of Vickers, Ltd., commented upon the public claim recently made by Mr. Chas. Schwab, Chairman of the Bethlehem Steel Co., for the new Bethlehem West two-cycle type marine Diesel-engine. Sir Trevor stated that:

"Mr. Schwab will perhaps be surprised to hear that Vickers have for a considerable time been experimenting with a two-cycle marine-engine. We do not admit for a moment that Mr. Schwab has beaten us. We are well on with him in every single particular, for after very far-reaching experiments our four-cycle marine Diesel-engine is preferable to the Schwab discovery. The four-cycle engine is simpler, and takes less technical skill to drive it. Moreover ,the two-cycle engine needs more auxiliary apparatus. We are at present experimenting with many new types of internal-combustion engines. We are abreast, if not ahead, of anything America can produce in this line. Possibly it will be better if the British press kept the world informed of what is being done in the way of British achievements.

"I believe motor-driven passenger liners are an engineering possibility, but vast experiments will be necessary before such ships will attract the notice of passengers. The risk of breakdowns must be eliminated, and our aim in Vickers is to make these engines as perfect as human skill can make them. The new motor-tanker, the *Narragansett*, which Vickers-engined throughout, is a typical of British skill. It cannot be surpassed by America. This ship kept up an average speed of 11.1 knots across the Atlantic, and the total oil-consumption was only 12 tons daily. In a reciprocating oil-fired ship, 36 tons daily would have been required, and in a coal-driven vessel 50 tons of coal would have been required.

"This ship is a motor-driven unit, of which Mr. Schwab will recognize its epoch-making character. It will help Britain to get her share of American oil. This vessel has a 10,000 tons dead-weight, and a bunker oil capacity of 712 tons. It will carry 9,420 tons of oil. The two oil-engines have a brake-horse power of 3,500. All this is produced at cost hitherto believed to be impossible . Mr. Schwab's discovery alarms me not at all. When motor ocean-liners become a possibility British shipowners need not send their orders to America."

We have drawn Sir Trevor Dawson's statement to Mr. Schwab, and hope to be able to publish the latter gentleman's answer at a later date.

### "GLENGARRY," ANOTHER 14,000 TONS D.W.C. MOTORSHIP FOR THE GLEN LINE

"Glengarry," the third of the *six* new 14,000 tons 6,600 i.h.p. motorships for the Glen Line, was launched at Harland & Wolff Govan yard on September 30th.

### ANOTHER WERKSPOOR-ENGINED MOTORSHIP ORDERED

An order for a motorship has been placed by the De Schelde Shipbuilding Company by the K.N.S.M. of Amsterdam, Holland. The vessel will be propelled by a six-cylinder Werkspoor Diesel-engine.

### THE HANDWRITING ON THE WALL

Sir Walter Runciman, who recently formed the Runciman Steam Navigation Co., with a capital of $4,500,000.00 with the funds obtained through selling the well-known Noor Line, stated that many American *steam*ships will be scrapped. We can endorse Sir Walter's opinion, as this will soon be the case unless our vessels are converted to economical Diesel-power before it is too late. However, we are willing to wager that Sir Walter will be unable to operate his steamships in competition with American motorships, should they ever ply over the same routes.

### SHIPPING BOARD'S DIESEL ENGINES

A large number of McIntosh & Seymour and Skandia-Werkspoor Diesel engines now under construction for the U. S. Shipping Board are to be sold at prices substantially equal to their present reproduction cost. Every effort will be made by the Board to have these engines installed in American vessels of suitable size and type. The first pair of 900 shaft h.p. cross-head type McIntosh & Seymour engines have already been sold through the McIntosh & Seymour Corporation to the Alaska Steamship Company. The Shipping Board will allow liberal terms of payment.

### REPLACING DISTILLATE MOTORS ON THE PACIFIC COAST

#### Construction of Small Marine Oil-Engines

By R. D. WATSON, C.M.A.A.E.

SMALL and medium powered marine oil-engines are rapidly encroaching upon the field—particularly on the Pacific Coast—which only a few years ago was occupied almost exclusively by heavy-duty distillate and gasoline engines. While the Diesel-engine is giving excellent account of itself in large vessels, it possesses too many features of a complicated nature, both from a manufacturing as well as from an operating standpoint, to render it very adaptable to the small commercial craft, which play such a large part in the industrial activity of the Pacific Coast.

Some of the European oil-engines are splendid examples of ingenuity in design and excellence of construction, but they exhibit too many small parts, liable to derangement, to become popular with the work-boat owner or operator in this country. The size of engine to which this article is intended to apply, may be taken as from 50 b.h.p. up to about 250 b.h.p., which will cover most of the needs of cannery-tenders, small tow-boats, fishing-schooners, etc.

An engine to operate successfully under the somewhat trying conditions attending the use of these craft, must have the same features of reliability and be constructed along the same rugged lines to which the heavy-duty "gas" engine owes its reputation. The engine which will eventually be evoloved to meet these needs, will of course be some form or solid-injection engine, for the elimination of the air-compressor is one of the necessities towards the successful adoption of the oilgine by the small-boat man. Apart altogether from manufacturing considerations and the extra cost, the proportion of power absorbed by the compressor renders its use out of the question for engines of the size under consideration. Another disadvantage is the presence of high-pressure piping, flasks, etc., very undesirable adjuncts in the hands of operators not too highly skilled.

Too much stress cannot be laid on the absolute necessity of providing ample bearing-surface, especially for the piston-pin. Some makers in an endeavor to make the top-end bearing adjustable, go so far as to reduce the size of the pin in order to find room for the bolts. Such practice is to be condemned, and it is vastly better to provide the upper end of the connecting-rod with a solid eye, into which a phosphor-bronze bushing is pressed. This in conjunction with a stepped piston-pin is a good manufacturing proposition, while replacements due to wear are easily made. The pin can be of adequate size for its load and the bearing is fool-proof.

Under the best of conditions the pin has to carry a load in excess of 2,200 lbs. per sq. in. of its bearing-surface, and the writer has seen cases in which 3,000 lbs. was nearer the mark. An empirical rule which is well borne out in the best modern practice, makes the diameter of the pin equal to 0.4D, when D is bore of cylinder in inches. Too light a piston is not advisable, apart from considerations of strength, or those relating to the presence of reciprocating weights. A piston, the walls of which are fairly heavy, will conduct the heat away from the piston-crown very much better than one with walls reduced to the least possible thickness. Forced lubrication is of course a *sine-quanon* in these engines and the supply to the piston-pin is best accomplished by an axial hole in the connecting-rod. Pipe connections in this particular location usually give trouble by jarring loose.

The question as to whether a governor is, or is not, desirable on a marine engine is an open one. The writer's personal opinion is that it is an article that can very easily be dispensed with, provided a good hand control is fitted. The fuel-pumps of engines working on the open-nozzle and similar systems, whire the pump is not at any time subjected to high pressure, are most easily controlled by varying the stroke, but in closed-nozzle and solid-injection engines in which the pump has to work against pressure, the regulation must be accomplished by controlling the suction-valve lift, or by some form of by-pass.

Reversing in sizes below 100 b.h.p. is best obtained through a mechanical reverse-gear between the engine and propeller shaft. Reversibility of the engine itself entails the use of extra parts of small size, as well as the provision of larger air-storage tanks than would otherwise be required. Also the average operator has more confidence in a reversing-gear, having been familiar with it in his "gas"-engine experience. On the larger sizes, two-cycle starting and reversing on air will render the engine easier to handle and quicker to respond without much added complication.

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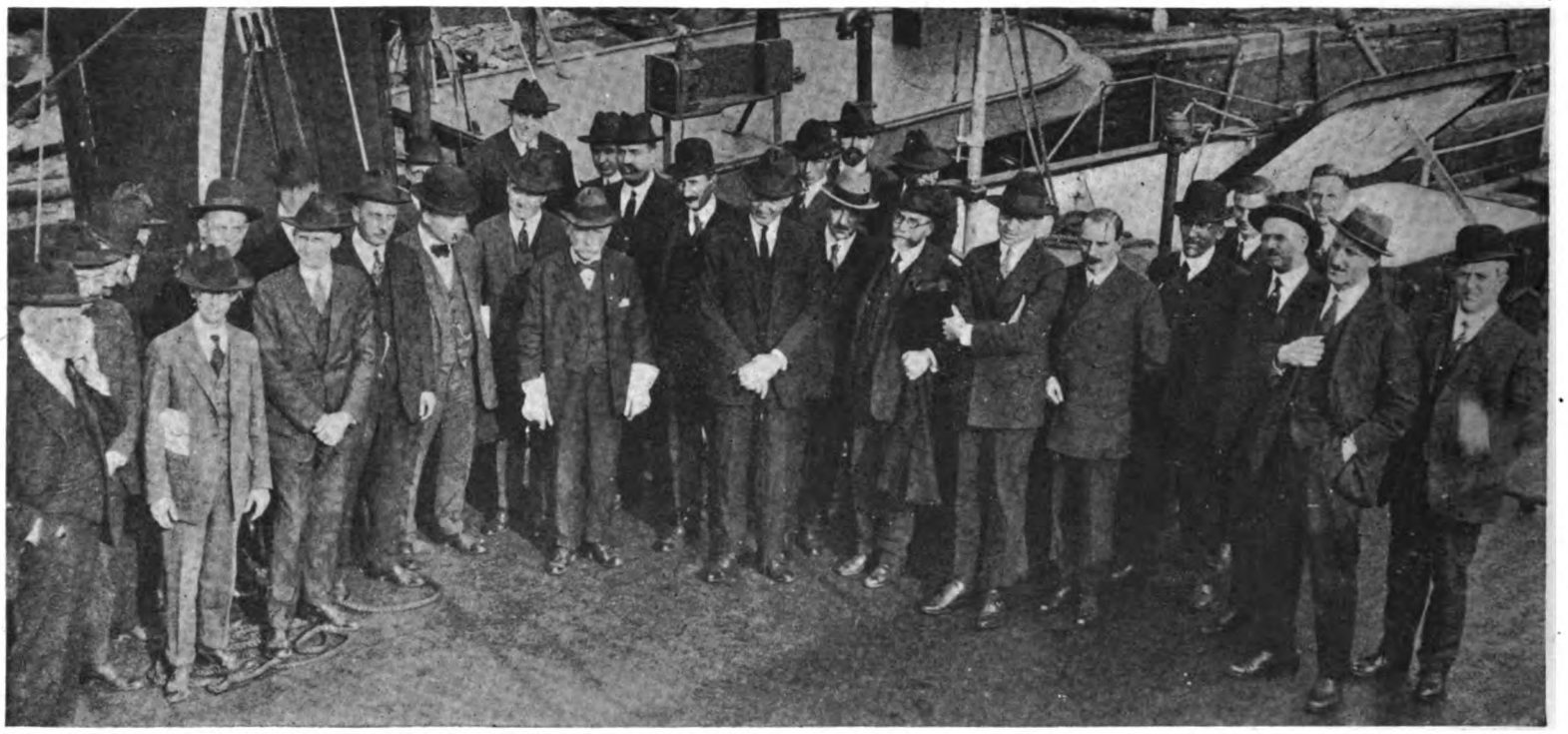


*Photo by Editor of "Motorship"*

**Some interested visitors aboard the motorship "Narragansett." On the extreme right is Mr. Eames, director of the Anglo-American Oil Co., owners of the vessel.**

# Motorship "Narragansett" Visits New York

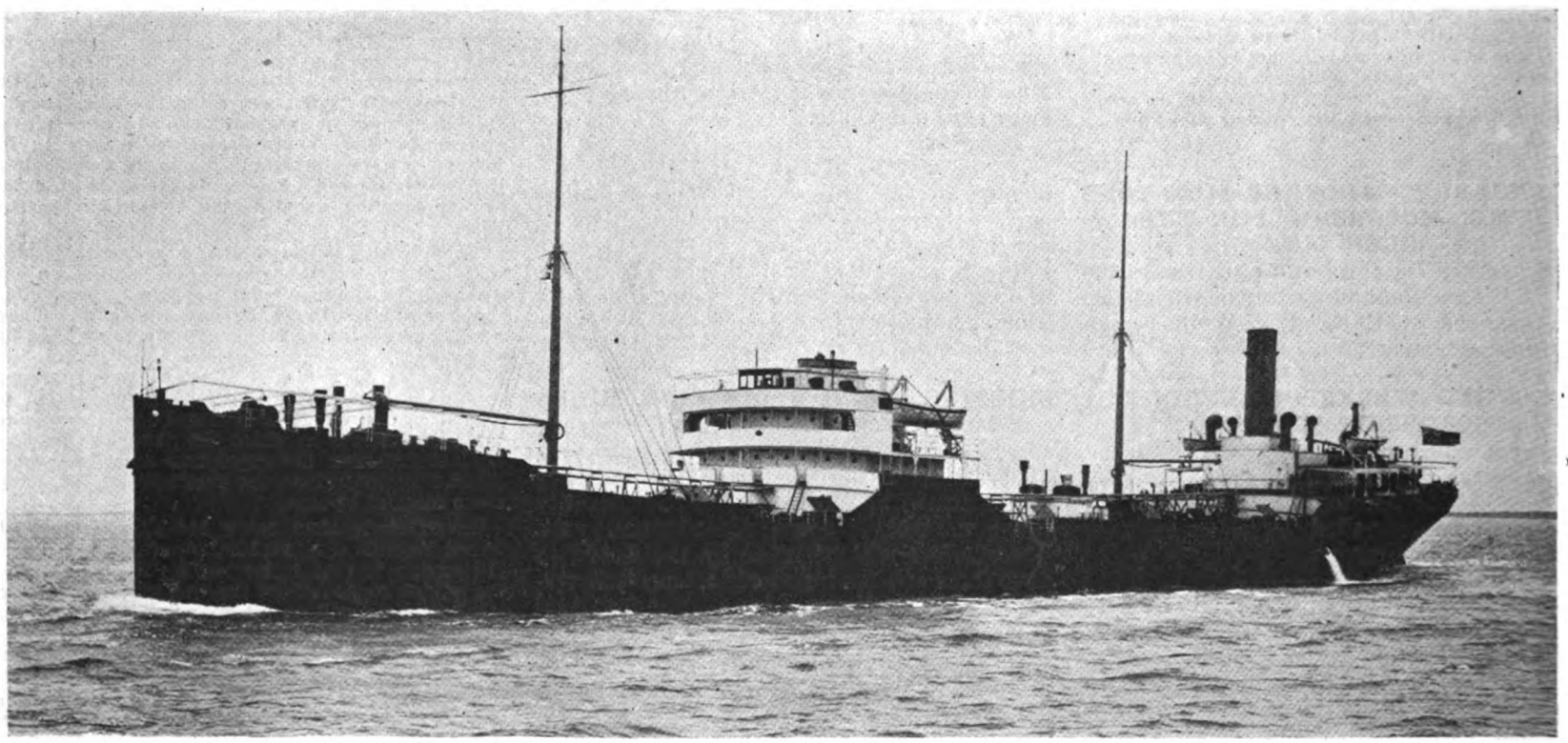
## *Vickers'-Engined* 10,500 *Tons D.W.C. Tanker a Most Interesting Vessel*

BECAUSE of the probability of the Vickers' solid-injection Diesel-type oil-engine being installed in a number of American merchant ships in the "not too-distant" future, the first of the post-war motorships built by this well-known British engineering and ship-building firm caused quite a vigorous interest on the occasion of her first visit to New York. So numerous were the requests received by her owners during the short stay of the vessel, that they were unable to extend the desired privilege in a general way. Nevertheless, those who managed to get aboard were rewarded by a very interesting time.

This vessel was very fully illustrated and described in our issue of July last, and is fitted with twin 1,250 brake h.p. "Diesel" engines, having high-pressure spring-injection of fuel without compressed air-injection, and the system is generally known as "solid-injection," having the advantage of dispensing with high-pressure air. Greater economy than is possible with the air-injection type of Diesel engine is claimed for solid-injection, and on the 2½ hours maximum speed trials of the ship the consumption was 0.385 lb. per brake h.p. hour, or equivalent to 0.28 lb. per indicated h.p. hour. This compares with 0.95 lb. per indicated h.p. hour for the very best oil-fired geared-turbine practice, *or less than one-third of the consumption,* meaning a saving of fuel of over 150%.

We will repeat a few of her principal dimensions:

| | |
|---|---|
| Loaded Displacement | 14,000 tons |
| Fuel Capacity | 750 tons |
| Fuel Necessary for Round Trans-atlantic Voyage | 350 tons |
| Total Cargo-Capacity | 486,000 cu. ft. |
| Length | 425 ft. |
| Breadth (moulded) | 56 ft. 8 ins. |
| Depth (moulded) | 33 ft. |
| Draft | 26 ft. |
| Contract Speed | 10.50 knots |
| Trial Speed (on 26 ft. 2 ins. draught) | 11.24 knots |
| Loaded-Speed on Maiden Return Voyage, | 11.10 knots |
| Brake Horse-power | 2,500 h.p. |
| Engine Speed | 118 R.P.M. |
| Cylinder Bore and Piston Stroke | 24½ x 39 ins. |
| Auxiliary Machinery | Steam-driven |
| Auxiliary Oil-engine | Vickers-Petters |
| Captain | W. Gray |
| Engine-Room Crew | Chief-Engineer, 1st, 2nd, 3rd and 4th Engineers, 2 Assistant-engineers, 3 |



**The 10.500 tons d.w.c. motor-tanker "Narragansett" built and "Diesel" engined by Vickers, Ltd., of Barrow for the Anglo-American Oil Co.**

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Chief-Engineer H. L. Rawes (on the right) and First Engineer R. J. Dunn evince an interest in "Motorship"

Greasers and 3 Firemen.....Total 13 men
Daily Fuel-Consumption of Main Engines.9¼ tons
Daily Consumption of Aux. Boiler.....2¾ tons
Daily Lubr.-Oil Consumption.....15 gallons
Cost of Fuel (Diesel-Oil).....$5.55 per barrel
Fuel-Injection-Pressure .....4,000 lbs. per sq. in.

It was intended to load her in New York and start back to England 48 hours after her arrival, as her Diesel engines were in a most excellent condition; but, owing to a liner in a stern-tube pressing and seizing on a propeller shaft it was necessary to send her to Brooklyn for a couple of days. Not a repair had to be made to her propelling machinery, speaking well for its reliability.

This is the "Narragansett's" second visit to America—she first having gone to New Orleans, La., using Texas residual-oil fuel. On the trip back to England fully-loaded, she averaged 11.10 knots, or one-half knot over her contract speed. Chief Engineer H. L. Rawes advised us that on this run her engines maintained the rated speed of 118 r.p.m., indicating 1,500 h.p. each on a total daily consumption of 9¼ tons of Anglo-American Diesel-oil costing $5.55 per 42-gallon barrel. This we understand is similar to the Standard Oil Co.'s solar-oil. The distance on this trip was 4,528 nautical-miles. The estimated shaft h.p. output was 2,120 h.p., thus giving a b.h.p. consumption of 0.428 lbs. per hour. In addition to the above fuel, the auxiliary boiler used 2¾ tons per diem.

Chief-Engineer Rawes is also guarantee-engineer from the Works, and later on his place will be taken by Senior First-Engineer R. J. Dunn. An interesting innovation is the carrying of three apprentices from the Vickers Works in the engine-room of the ship. an example that could be copied with profit by American shipowners in co-operation with Diesel engine-builders.

We were sorry to see that steam auxiliaries occupied so important a position in this ship, especially as the "Marinula," another large Vickers-engined bulk-oil carrying motorship has all Diesel-electric auxiliaries, including the cargo-pumps. However, the large multi-tubular boiler installed over the engine-room supplies steam for heating the coils in the holds and for operating the two 200-tons cargo-pumps. There also is a small Cochran donkey-boiler in the engine-room for steam heating. for the galley cookers, for the ballast and fuel pumps; for the air-compressors. and for running the lighting dynamo at night. The lighting during daytime is provided by a Vickers-Petters surface-ignition oil-engine and dynamo set. The big boiler is only used when the ship is in port.

It is our opinion that with Diesel propelling-machinery of this power, sufficient steam could be obtained from a boiler of about 1200 sq. ft. heating surface at 80 to 100 lbs. pressure, solely from the exhaust-gases when the ship is at sea, for the purpose of running thro' the heating-coils in the holds when the vessel is carrying very heavy oil-cargo, such as the low grade Mexican crude.

At any rate the heat thus derived and used during the entire voyage would keep the oil cargo in a semi-fluid state, and when the ship neared port it could be augmented by oil-firing the boiler if necessary. All the other auxiliaries, such as the cargo-pump and general engine-room equipment could then be on the economical Diesel-electric system, with all electric-motors specially enclosed and ventilated, as was done in the case of the American motor tanker "Solitaire," which has given such excellent results in operation carrying bulk gasolene as cargo.

Speaking of ventilation, we noticed a new departure in the "Narragansett." There are special air-induction pipes for tropical weather, enabling the engines to draw their supply of atmosphere direct from outside the ship. But, whether anything is to be gained is a moot point without further experiences, because we should think that the large quantity of air that these engines must use every minute would ensure of a steady flow of pure atmosphere thro' the skylight and ventilators at all times, and assist to keep the air in the engine-room wholesome and cool. Thus not only would the engines be receiving pure air, but also the engineers would benefit.

In the engine-room there also is a small electric-driven refrigerating-set made by the Pulsometer Engineering Co. An American motorship of this size would have a larger ice-plant, but Britishers are not accustomed to the extensive use of ice that Americans are. Iced water, other iced drinks, and ice-cream are part of an American's daily diet both winter and summer; whereas to the average Englishman iced-water is almost unknown, unless he has lived in the United States, while ice-cream is a luxury only for the hot months, while a whiskey and soda with ice in it would be considered spoiling good spirit. Their climate does not call so strongly for the wide use of ice, but a plentiful supply is a great boon on board ship once one has become used to its benefits, particularly on a ship coming to America on tropical waters during the summer months.

On this voyage to New York the ship had eight days of very heavy weather out of fourteen days, and being in ballast only averaged 9.6 knots. Although the Aspinall governor fitted to each engine is not used, the Chief-Engineer stated that propeller racing is very slight indeed and that the revolutions never exceeded 135 r.p.m. when the propeller was out of the water, and that the increased speed is much more gradually attained than with steam-engines, being held down by the 11-tons flywheel fitted to each engine. We presume that this is the only reason for cutting-out the governor.

Michell thrust-blocks are adopted, and these are similar to the well-known Kingsbury thrust. For heating heavy fuel-oil there is a steam-heating device on the suction supply-pipe of each main engine and steam-pipes in the side bunkers. The engines are flexible and have a variation in service down to 48 r.p.m. For further details regarding the "Narragansett," see "Motorship" for July, 1920.

Captain W. Gray of the motorship "Narragansett"

## NEW MOTORSHIP OF 15,000 TONS DISPLACEMENT FOR NORWEGIAN OWNERS

THE new cargo-passenger motorship "Theodore Roosevelt" referred to in a recent issued has been delivered by Burmeister & Wain of Copenhagen, Denmark, to Fred Olsen & Company of Christiania, Norway, to replace the motorship "Bonheur" sunk by a mine in the North Sea on her maiden voyage during the war. Trials have been successfully run and a mean-speed of 11.97 knots attained. Her dimensions are as follows:

Loaded Displacement .....15,065 tons
Light Displacement .....4,000 tons
Carrying Capacity (grain).....567,000 cu. ft.
Carrying Capacity (bales).....524,400 cu. ft.
Water Ballast .....1,422 tons
Fuel Capacity .....1,284 tons
Cruising Radius .....120 days (30,000 miles)
Daily Fuel-Consumption .....10½ tons
Number of First-class Passengers.....10
Power of Main Engines.....3,100 I.H.P.
Power on Trials .....2,982 I.H.P.
Engine Speed on Trials .....133 R.P.M.
Designed Engine Speed .....125 R.P.M.
Ship's Speed on Trials.....11.97 Knots
Designed Loaded-Speed of Ship.....11 knots
Propellers.....12 ft. dia. by 9 ft. 3 ins. pitch
Power of Aux'l Diesel-Electric Engines Three 60 K. W. 224 volt sets
Engine-Room Staff .....12 officers and men
Draught on Trials 5 ft. 8 ins. forward by 13 ft. 9 ins. aft.
Length (O. A.) .....444 ft. 4 ins.
Length (B. P.) .....425 ft. 5½ ins.
Breadth .....55 ft.
Depth from Awning Deck.....38 ft. 6 ins.
Depth from Upper Deck .....30 ft. 6 ins.
Depth from Lower Deck .....22 ft. 6 ins.
Height of Double Bottom .....3 ft. 8 ins.
Draught, loaded .....29 ft. 1 in.
Class .....Norwegian Veritas & Lloyd's 100 A 1

For heating the ship there is a small oil-fired donkey-boiler that can also furnish steam to an emergency air-compresser. Her main Diesel engines are of the four-cycle type and were built by Burmeister & Wain. The steering-gear is of the Brown Bros. electric-hydraulic type. For handling the cargo the ship has one 25-ton derrick, one 10-ton derrick and ten 5-ton derricks. She has five hatchways fitted with eight 3-ton winches and two 5-ton winches, one electric anchor-windlass, and one electric warping-winch. The ship is equipped with a wireless installation. There is no smokestack, the exhaust-gases being carried up the after mast.

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# New Foreign Motorship Construction Notes

### ORIENT S.S. CO.'S MOTORSHIP "INDIEN"

"Indien," the first 8,900 tons d.w.c. Diesel-driven motorship of the Orient Steamship Co. of Copenhagen, was launched on June 26th last at Naskov. This is the company that purchased the old steamer fleet of the East Asiatic Co. several years ago.

### LAUNCH OF THE MOTORSHIP "SAN PAULO"

The 6,500 tons d.w.c. motorship "San Paulo" was launched at the Rijkee Yard, near Rotterdam, Holland, on September 24th. She is a twin-screw vessel, propelled by two 1,400 i.h.p. Werkspoor Diesel-engines, and is owned by the Otto & Thor Thoresen Line of Kristiania, Norway.

### "GLENAPP" RE-NAMED "ABA" AND REPLACED BY ANOTHER "GLENAPP"

The motorship "Glenapp" is now owned by the Elder-Dempster Co.—not the East Asiatic Co., and has been re-named "Aba." The second of the Glen Line's new 14,000 tons motorships has been named "Glenapp" —the first being the "Glenogle."

### NEW AMERICAN DOUBLE-ACTING ENGINE

No less than 2500 shaft h.p. at 80 r.p.m. in a space 24 ft. long is claimed for the new Ingersoll-Rand-Price four-cycle type double-acting solid-injection marine oil-engine for which designs have been completed. The 1700 shaft h.p. single-acting marine oil-engine now being constructed by this firm is in the erecting stage, and trials will be run within six months.

### CHARGEURS REUNIS' MOTORSHIP

The Diesel-driven motorship now under construction at the yard of the Chantiers de la Loire to the order of the Chargeurs Reunis, of Paris, France, will have the following dimensions:

| | |
|---|---|
| Dead-weight Capacity | About 12,000 tons |
| Speed | 12 knots |
| Length (B. P.) | 452 ft. 1 in. |
| Breadth | 59 ft. 3 ins. |
| Depth | 40 ft. 3 ins. |
| Power | 3,400 shaft h.p. |

She will have three decks and in the engine-room there will be twin four-cylinder, two-cycle type Sulzer Diesel engines of 1,700 shaft h.p. each directly coupled to the propeller shaft.

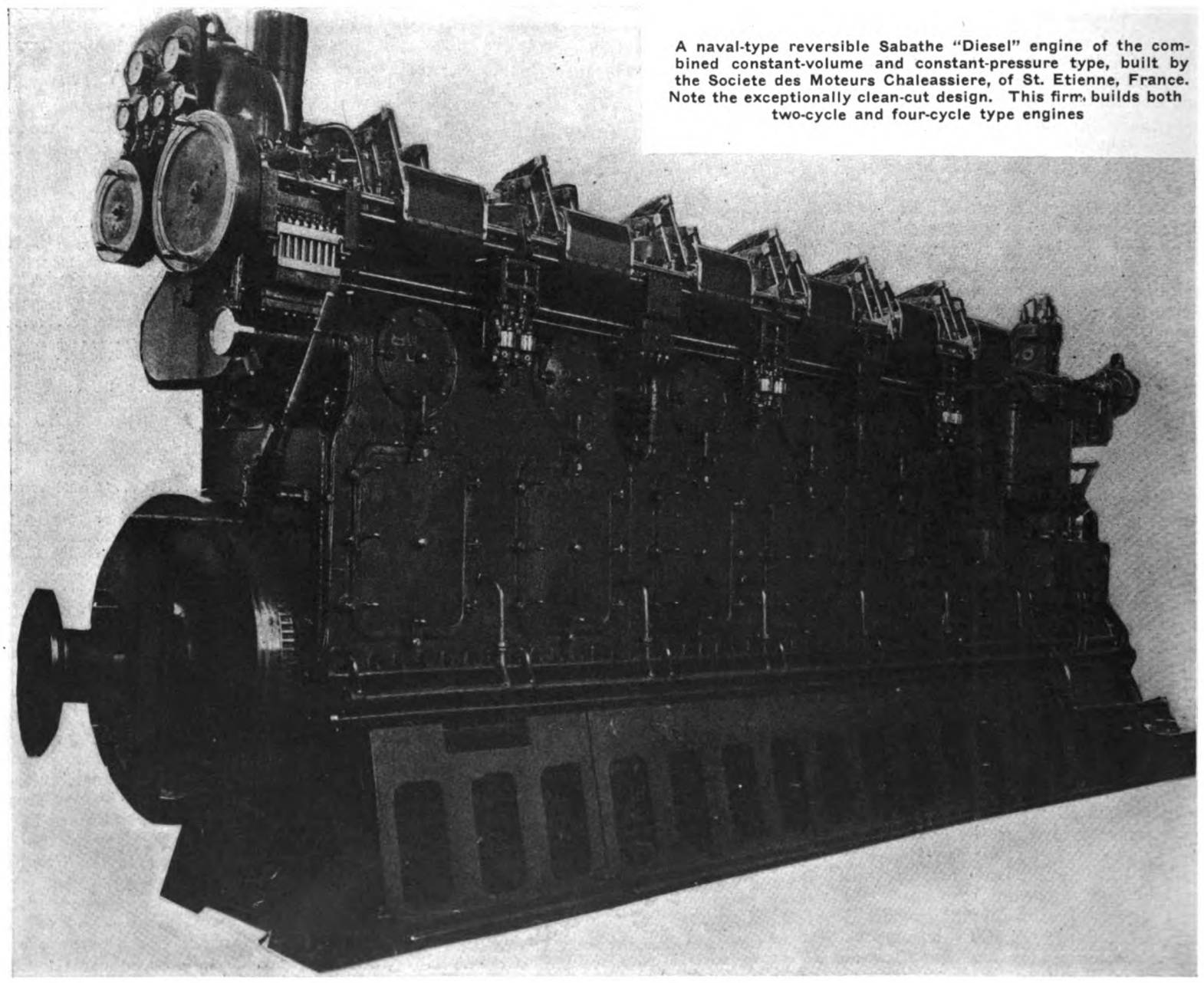
### LAUNCH OF FIRST DOXFORD STANDARD 9,350 TONS D.W. MOTORSHIP

"Yngaren," the first of the three standard 9,350 tons d.w.c. two-cycle Diesel-engined motorships building for the Rederiaktiebolaget Transatlantic of Gothenburg, Sweden, was launched by Wm. Doxford & Sons, Ltd., Sunderland, England, on Sept. 28th last. She is fitted with the four-cylinder 3,000 i.h.p. (2,700 shaft h.p.) Doxford opposed-piston solid-injection oil-engine turning at 70 r.p.m. The cargo capacity of this ship is 560,000 cu. ft. with a displacement of 12,750 tons on a draught of 25 ft. 6 in. The bunker capacity is 1,130 tons, giving a radius of 32,000 nautical-miles at 10½ knots. Bore & Stroke of the main engine is 22.834 in. and 45.669 in., respectively. Owing to pressure on space we are obliged to hold over further details which we have before us.

### ALLIED POWERS PROPOSE PROHIBITING CONSTRUCTION OF DIESEL ENGINES IN GERMANY

According to a report from the Berlin office of the New York "Tribune" under date of Oct. 16th, the Allied Powers propose to prohibit further construction of Diesel oil-engines in Germany, and to destroy all existing Diesel-engines whether used originally in submarines or in private industry.

We cannot believe that the Allied powers will take such a drastic step and feel convinced that the United States Government would not agree to such a mistaken and destructive policy. Germany needs Diesel engines in large quantities, not only for rebuilding her merchant-marine but for many industrial purposes on land. The Diesel-engine is a machine of commercial advance and national economy. That it was also used by the Germans for propelling submarines is no logical reason for the above decision. The Allied Powers on the same reasoning may as well prohibit the manufacture of steel plates and angles because the latter were also used to build submarines.



A naval-type reversible Sabathe "Diesel" engine of the combined constant-volume and constant-pressure type, built by the Societe des Moteurs Chaleassiere, of St. Etienne, France. Note the exceptionally clean-cut design. This firm builds both two-cycle and four-cycle type engines

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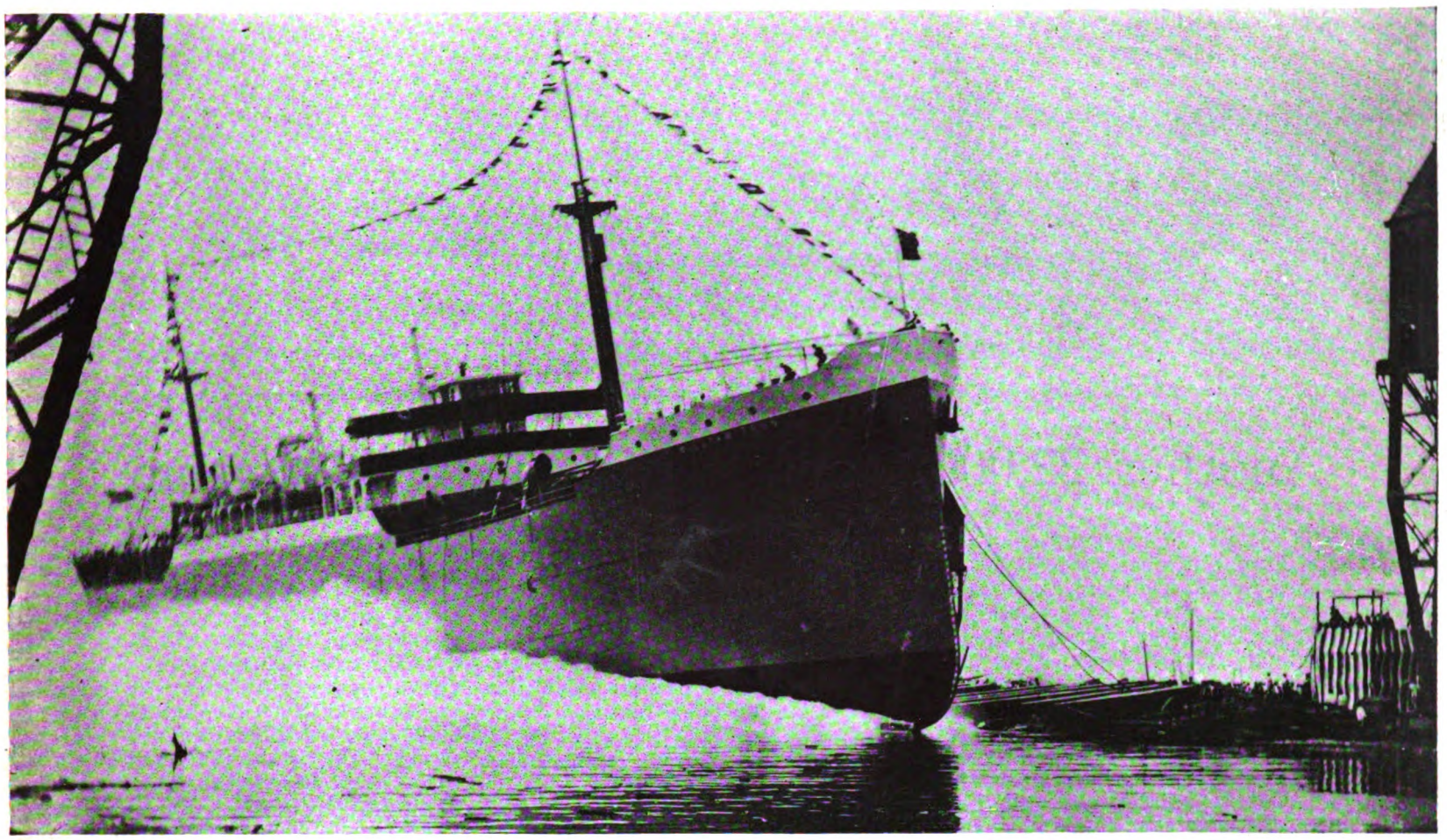
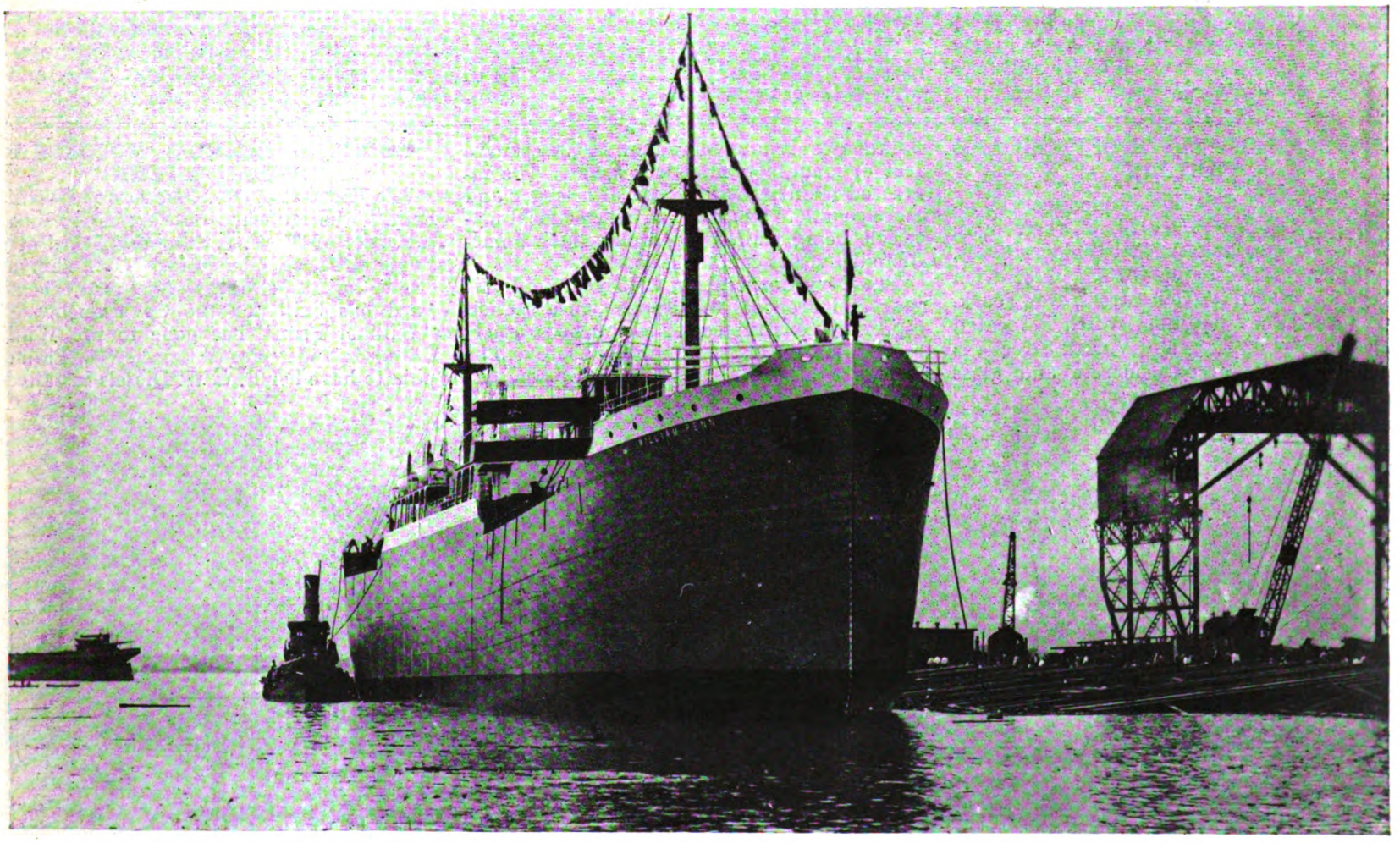
# RESULTS OF THE U. S. GOVERNMENT MERCHANT SHIPBUILDING!

**The vessel illustrated below is the only motorship built by the U. S. Shipping Board out of a total of nearly 2,000 merchant craft.**



## UNIQUE EVENT IN HISTORY OF MOTORSHIP BUILDING

**Broadside launching of the 12,500 tons d.w.c. motorship "William Penn" at the Pusey & Jones, Gloucester, N. J., shipyard to the order of the U. S. Shipping Board. This is the first time a large steel motorship has been launched sideways.**



## ONE OF AMERICA'S LARGEST MOTORSHIPS

**The U. S. motorship "William Penn." Two 2,250 i.h.p. Burmeister & Wain-built four-cycle type Diesel-engines are being installed by Wm. Cramp & Sons Ship and Engine Co. at Philadelphia, Pa.**

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"Delivery No. 5" Standard Oil Company's new coastwise tanker. She is propelled by a 300 b.h.p. Standard gasoline engine. She was built by the Staten Island Shipbuilding Co., Staten Island, N. Y.

# Another 22,000 Tons Displacement Motorship

*New 14-Knot Passenger-Cargo Diesel-Driven Liner Building for the East Asiatic Company*

SO rapidly is the size of motorships increasing in Europe it seems as though America must remain behind in Diesel-engine development for several more years, even if shipowners vigorously take-up the construction without further delay. This must be regarded as an unsatisfactory state of affairs—not only by our Diesel-engine builders who are anxious to receive the co-operation that will allow them to make big strides, but also to shipping men who up to now have been doubtful regarding the success and value of the motorship.

The East Asiatic Company of Copenhagen, Denmark, who from the earliest days of the motorship industry have demonstrated that its directors are progressive and fearless, have once again shown that they intend their merchant-fleet shall continue to be the most efficient, the most modern, and the most economical in every respect by recently ordering a twin-screw vessel, which will take its place among the largest and speediest now under construction. This vessel has been contracted with Burmeister & Wain, and will have the following dimensions:

| | |
|---|---|
| Displacement (loaded) | 22,150 tons |
| Dead-weight Capacity | 15,400 tons |
| Net Cargo-capacity on 109 days cruising radius (34,000 miles) | 13,350 tons |
| Hold Capacity (Bales) | 730,000 cu. ft. |
| Refrigerating-Hold Capacity | 50,000 cu. ft. |
| Total Cubic-Capacity (Below Deck) | 780,000 cu. ft. |
| Fuel-oil Capacity | 1,960 tons |
| Passengers Carried | 12 |
| Horse-Power of Main Engines | 6,000 i.h.p. |
| Speed (loaded) | 12½ knots |
| Daily Fuel-Consumption | 18 to 20 tons |
| Length (O. A.) | 502 ft. |
| Length (B. P.) | 485 ft. |
| Breadth (Mld.) | 64 ft. |
| Depth to Aux. Deck | 43 ft. |
| Depth to Upper Deck | 34 ft. |
| Depth to Lower Deck | 24 ft. |
| Draught (loaded) | 32 ft. |
| Block Co-efficient | 0.775 |
| No. of Hatches | 7 |
| No. of Winches (59 tons total) | 20 |
| Engine Speed | 115 R.P.M. |

For propelling the ship twin direct-reversible four-cycle type Burmeister & Wain Diesel engines will be installed, each having an output of 3,000 i.h.p. at 115 r.p.m. from eight cylinders 29.134 in. bore by 41.338 in. stroke. This is the same size of engine as installed in the British 14,000 tons d.w.c. motorship "Glenogle" and sister vessels.

All the auxiliary machinery will be of the Diesel-electric type. On deck there will be four electric-winches of 5 tons capacity, ten of 3 tons and six of 1½ tons, which will work 7 hatches. Wireless will be carried and the vessel is being built to British Lloyds +100 A1 clasification. In type and construction this new ship will be similar to the East Asiatic Company's smaller motorship "Afrika," which is of 13,250 tons d.w.c. and of 4,250 i.h.p.

## CORY COMPANY MOVE OFFICES AND FACTORY

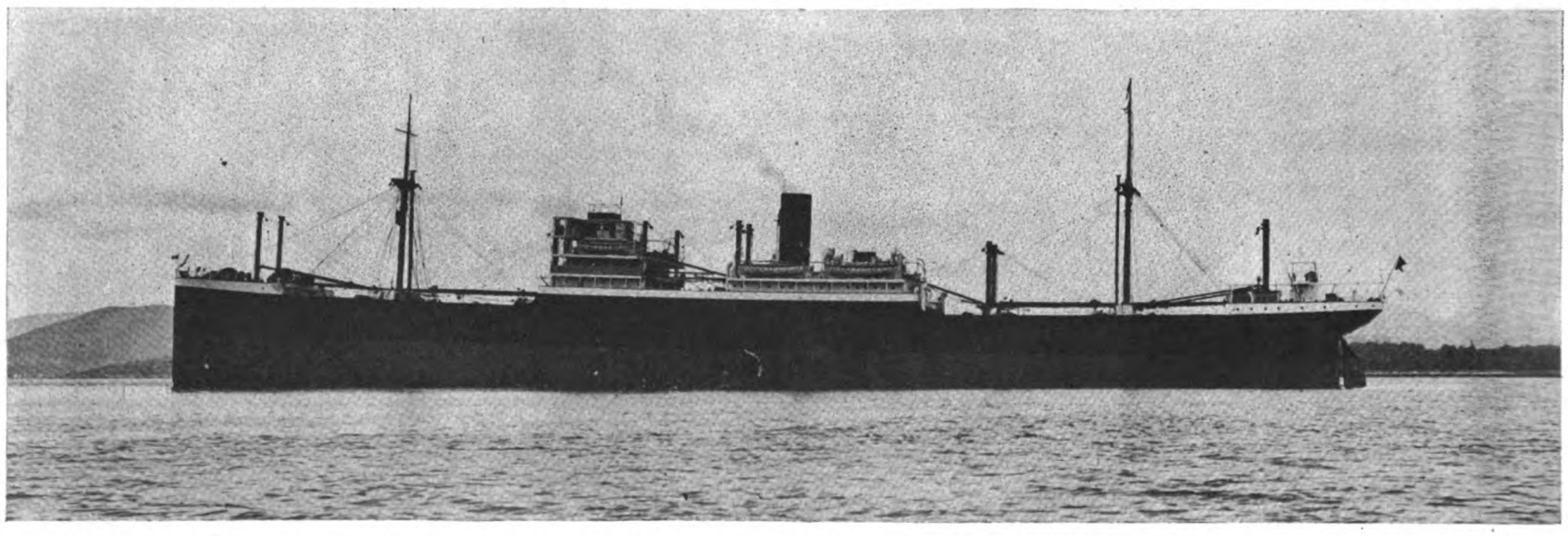
Chas. Cory & Son, Inc., announce the removal on October 15, 1920, of their main office and factories from 290 Hudson Street, 186 Spring Street and 487-489 Greenwich Street, to 183-187 Varick Street, New York.

The new Cory building, which is located on the corner of King and Varick Streets, is a modern re-enforced concrete and glass building containing more than 100,000 square feet of manufacturing floor space. The increased facilities will permit of a larger and more complete stock of marine electrical materials being maintained from which immediate deliveries can be made.

The Cory Corporation is 75 years old this year and proposes to establish, in a section especially constructed for the purpose, a permanent marine exposition where there will be displayed all types of ships' equipment.

## SHIPPING BOARD'S MOTORSHIP "WILLIAM PENN"

The 12,500 tons d.w.c. motorship "William Penn" was launched on September 15th to the order of the U. S. Shipping Board at the Pusey & Jones, Gloucester, N. J., shipyard. She is the 20th and last vessel that this shipyard has built for the Government. The "William Penn" has gone to the William Cramp & Sons Ship & Engine Co., Philadelphia to have her B. & W. Diesels installed.



The British 14,000 tons 14-knot motorship "Glenogle" built by Harland & Wolff. A sister-ship the "Glengarry" was launched on Sept. 30th last.

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# MOTORSHIP

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RUSSELL PALMER.....Manager
GEO. F. FARRAH.....Advertising Manager

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# EDITORIAL

## THE OUTLOOK

Never has the American motorship industry looked more favorable, regardless of the general shipbuilding slump. This may come as a surprise to most people in the shipping business unless they have kept close track of progress in this particular field. Never at any time have there been so many large steel-ocean-going Diesel-driven merchantships under construction in this country, and never before have there been so many prospective orders from private shipping lines in view. Generally speaking the situation is getting more like that now existing in Great Britian where *steam*ship orders have recently been cancelled wholesale, and where practically all new keels are to be completed as *motor*ships.

In America more new Diesel-driven motorships than steamers have been ordered during the last few months if we except a number of bulk-oil steam tankships recently placed by the leading oil-companies, whom perhaps could have shown a little more discriminating foresight. No fewer than *eleven* steel merchant motorships aggregating about 140,000 tons deadweight-capacity are now on order and under construction in United States shipyards for domestic shipowners. This constitutes a record tonnage in the history of the motorship development in the New World. Considering the present bad slump in dry-cargo steamship construction, we may regard the signs as very encouraging for the rapid growth of the Diesel-engine movement, particularly as four of these motorships are to be the largest of their type in the World, and will have a loaded-displacement of close upon 30,000 tons each. A complete list of these new motorships is given on the bottom of this page.

Several motorships of 4,000 to 12,500 tons d.w.c. have recently been placed in service on the Atlantic and Pacific Coasts, including the big ore-carrier "Cubore" and the tanker "Solitaire"; and two concrete motor-driven tank barges of about 4,000 tons displacement are now completing, bringing the total up to about 155,000 tons d.w.c.

As we write additional motorships are being planned for the Mallory Co.; the U. S. Steel Corporation; the Submarine Boat Corporation (one to be Diesel-electric); the United American Lines; The Texas Co., Kerr S. S. Co., Inc., etc., which may soon bring the total on order up to 200,000 tons. Also the Shipping Board may sell the 36 Diesel engines (1100 i.h.p. each) now completing, in which case we can expect to see suitable hulls ordered by private owners or else their existing steamers converted. Moreover, we can reasonably expect to see the new 2,400 i.h.p. Worthington Diesel-engine soon sold and placed in a hull, while before very long the Newport News Shipbuilding Co., may start on the Diesel engines and hull of a 17,000 tons d.w.c. tanker for the Standard Oil Co. Finally, several 2,500 h.p. Diesel-electric ships may be built for the Mississippi traffic. Several other motorship orders may soon be placed by steamship companies who recently have become serious believers in this class of vessel. Thus we have a grand total of over 300,000 tons d.w. on order or within reasonable prospects of being built within a short period. To-day the American *steam*ship building industry is not—*and may never again be*—in an equally fortunate position, if we disregard for the moment the fleet of steam-tankers recently ordered.

## —AND THUS IT CAME TO PASS!

We cull the following from the Sept. 28, 1920, issue of the *N. Y. Journal of Commerce*—"More than 30 steel ships representing an initial investment of more than $50,000,000.00 are to be tied up at New York and New London as the operators are unable to find cargoes which will permit them to operate the vessels at a profit. * * * Shipping men see no alternative to lay up other steel *steam*ships that cannot be operated economically. * * * Counting the wooden ships it is considered probable that there are perhaps 200 *steamers* tied up." Let us add—the worst is yet to come! When it is getting nearly too late there will be a rush to build economical motorships, but there will be little money left to pay for the same.

The same newspaper in its issue of October 8th reported that a number of the most experienced and successful operators of American ships had turned back more than one-hundred steam-driven cargo-carriers to the Board, including some of the largest steel freighters—these operators having advised the Board that they cannot operate the ships at a profit.

It will not be long before every American shipowner will agree that "Motorship's" claims and forecasts were based on the soundest of foundations and will bitterly regret their lack of foresight in not having built motorships since the Armistice instead of steamers. So far as America is concerned the death-knell has been rung over the profitable operation of steamers against foreign competition, and the foregoing is but an indication that the worst is yet to come.

## INSURANCE OF MOTORSHIPS

Several times recently we have referred to the higher insurance rate of ocean-going steel motorships required by American underwriters, compared with the rate of 5½% made by British and other European underwriters, the Americans having fixed 6%, owing to having suffered heavy losses in connection with many war-time "built" oil-engined auxiliaries, that generally are referred to as "motorships" without the proper discrimination. Discussing the hull-syndicate plan of insurance organized by the U. S. Shipping Board, "Nauticus" states:—

> **"It was organized for the purpose of writing steamships, hence it will not cover motorships for instance, although properly designed Diesel-engines attended by competent engineers are every bit as reliable as steam-engines. As far as the shipowner is concerned, it means further that if motor-vessels are added to the fleet, such vessels will have to be excluded from the annual policies covering the whole fleet and as syndicate underwriters are free to write regardless of tariff-rates any outside risks offered, *we may yet live to see motor-vessels written at cheaper rates than steamers*, or else we may see a shipowner covering his fleet in the pool here and being compelled to go to London for insurance on his motor-vessels; for there are indications that the leading American shipowners will go in for motorships, as practically every progressive owner in Europe is considering motorship construction. Is it not reasonable to suppose that such arbitrary restrictions may be conducive to the placing of some of the best American-owned fleets abroad by the local brokers, rather than be bothered with having to place separately every motor-driven vessel that is added to the slip during the currency of the policy?"**

We are very pleased to see "Nauticus" take up this matter so strongly, and hope it will result in American underwriters investigating the motorship situation a little more closely, in order that they may properly distinguished the great difference between badly built wooden sailing-ships underpowered with little hot-bulb oil-engines and modern slow-speed Diesel-driven steel motorships. The 100 to 200 h.p. high-speed hot-bulb (i.e. surface-ignition), motor is most excellent in its proper sphere, but it is out of its element in ships of 3,000, 4,000 and 5,000 tons d.w.c. But, the results of such craft should have no bearing on the insurance of big Diesel-driven steel motorships. Moreover, the interests of American underwriters is being protected by a committee of American oil-engine builders who, in conjunction with the American Bureau of Shipping, are engaged in forming a new and adequate set of rules for construction of motorship machinery which will tend for absence of breakdowns and even better reliability than steam machinery.

### MOTORSHIPS NOW BUILDING IN AMERICA

| No. of Ships | D.W.C. per vessel | Power per vessel | Makes of Engines | Type | Owners |
|---|---|---|---|---|---|
| 4 | 20,000 tons | 4,600 i.h.p. | Bethlehem-West | Two-Cycle | Bethlehem Steel Co., Bethlehem, Pa. |
| 2 | 11,200 tons | 4,500 i.h.p. | Cramp-B. & W. | Four-Cycle | American-Hawaiian S.S. Co., New York. |
| 1 | 12,500 tons | 4,500 i.h.p. | Burmeister & Wain | Four-Cycle | U. S. Shipping Board, Washington, D. C. |
| 1 | 5,010 tons | 2,200 i.h.p. | Skandia-Werkspoor | Four-Cycle | Standard Oil Co. of Cal., San Francisco, Cal. |
| 1 | 2,800 tons | 1,300 i.h.p. | Skandia-Werkspoor | Four-Cycle | Standard Oil Co. of Cal., San Francisco, Cal. |
| 1 | 6,500 tons | 2,400 i.h.p. | McIntosh & Seymour | Four-Cycle | Alaska S.S. Co., Seattle, Wash. |
| 1 | 9,000 tons | 2,500 i.h.p. | Craig | Four-Cycle | Submarine Boat Corp., Newark, N. J. |
| Total 11 | 138,210 tons | 40,300 i.h.p. | | | |

NOTE.—Two 1,900 tons d.w. 300 b.h.p. Bolinder-engined concrete tankers are also under construction.

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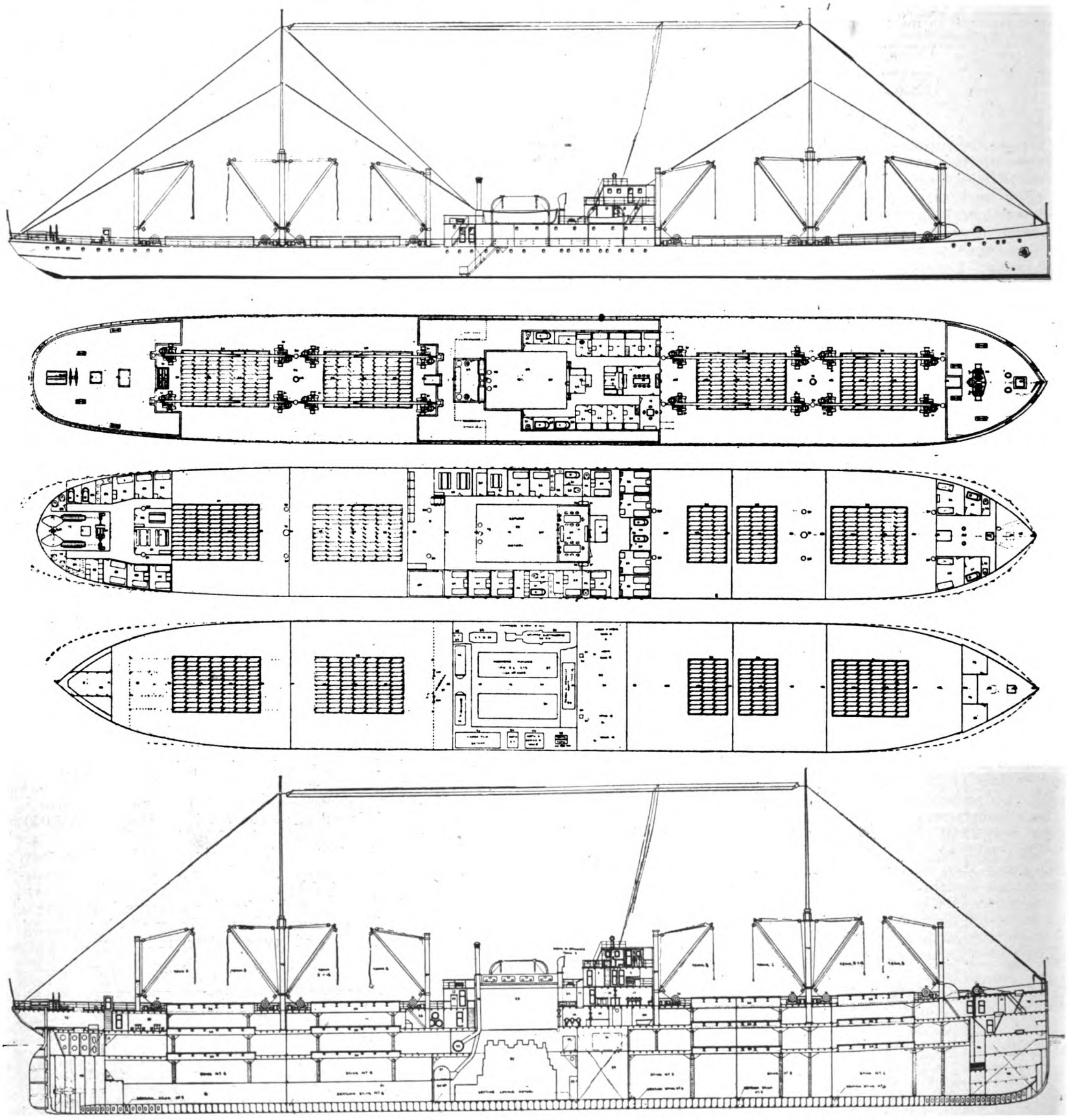
# More Italian Motorships

## *New 9,000 Tons D.W.C. Vessels Have Engines Installed Amidships*

FOLLOWING the special detailed story on Diesel motorship development in Italy published in our October issue, we are now able to reproduce drawings of the two new 9,000 tons d.w.c. awning-deck type motor-freighters that great pressure on space forced us to hold over. The new vessels are under construction but have not yet been named, so are known by their shipyard numbers; namely, 174 and 175. They are building to the order of the Societa Nazionale di Navigazione, of Genoa, and are laid-down at the Muggiano yard of the Ansaldo-San Giorgio, Ltd. Differing from these companies' previous motorships in that the machinery is installed amidships, there will be no smokestacks, the exhaust being carried-up small diameter standards aft the engine-room hatch. So in appearance they will be much smarter than the motorships now in service.

We have before us complete specifications of the new vessels covering about 200 pages of typewritten matter; but owing to great pressure on our space we are obliged to greatly condense the information. Their general dimensions are as follows:

| | |
|---|---|
| Loaded Displacement | 12,800 metric-tons |
| Net Cargo-Capacity | about 8,500 metric-tons |
| Dead-Weight-Capacity | 9,000 metric-tons |
| Length (O. A.) | 408 ft. 6 5/16 ins. |
| Length (B. P.) | 394 ft. 2⅜ ins. |
| Breadth (moulded) | 51 ft. 5⅝ ins. |
| Depth (to Awning Deck) | 38 ft. 11 ins. |
| Depth (to Main Deck) | 31 ft. ⅝ in. |
| Draught (with British Corp'n Freeboard) | 27 ft. 2 3/16 ins. |
| No. of W. T. Bulk-Heads | 8 |
| No. of Cargo Holds (excluding Deep-Tank used solely for Cargo) | 5 |
| No. of Hatches | 8 |



**Plans of two 9,000 tons d.w.c. combination cargo-passenger motorships building for the Societa Nazionale di Navigazione of Genoa, Italy, by Ansaldo-San Giorgio, Ltd., of Muggiano, Spezia. The machinery is installed amidships, contrasting with the other ships of this company that were illustrated in our last issue. The loaded displacement is 12,800 tons.**

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| | |
|---|---|
| Type of Auxiliaries | Diesel-electric |
| Power | 2,200 shaft h.p. |
| Ship's Speed (loaded) | 10.5 knots |
| Engine-Speed (rated) | 100 R.P.M. |
| Propeller Diameter | 12 ft. 2 ins. |
| Classification | British Corp'n 100 A1 Star |
| Daily Fuel-Consumption at Sea | 10 tons |
| Daily Fuel-Consumption in Port | ¾ tons |
| Shaft h.p. Hour Consumption | 0.43 lb. |
| Engine-Room Crew | 12 men |

Fuel is carried in three tanks between transversal bulkheads No. 86 and No. 94, which are extended to the double-bottom. On a round transatlantic voyage only about 320 tons of fuel will be burned, so the total net cargo-capacity will be about 8,600 tons, according to the class of freight.

The propelling-engines consist of twin four-cylinder two-cycle type reversible Ansaldo-San Giorgio Diesels, each 24.803-in. bore by 35.433-in. stroke, turning at 100 r.p.m., at which speed 1,100 shaft h.p. is produced per engine, giving the vessel a loaded-speed of 10½ knots.

In the engine-room there are two Ansaldo-San Giorgio four-cylinder two-cycle Diesel-engines coupled to 150-k.w. 220-volt electric-generators by means of flexible couplings. These sets will turn at 330 r.p.m. and provide current for all the engine-room and deck auxiliary-machinery, including sixteen electric cargo-winches (of which four will be of 5 tons' capacity) and for the electric windlass.

There also are two Ansaldo-San Giorgio single-cylinder two-cycle type surface-ignition oil-engines, each driving a 13-k.w. 220-volt electric-generator. There is a 13-k.w. generator driven by belt off one of the propeller-shafts for supplying current at 220 volts for the electric-steering-gear when the ship is at sea and the auxiliary Diesel engines are shut down. We presume that there is a "free wheel" and belt connected to the other propeller-shaft, in case of temporary stoppage of one of the main engines, so that a change over can instantly be made.

## LORD PIRRIE AND MOTORSHIPS

At the trials of the "Glenogle" Lord Pirrie stated that Harland & Wolff had determined to develop the Diesel-driven motorship with all the forces at their command. The 14,000 tons d.w.c. 6,600 i.h.p. motorship "Glenogle," illustrated and described last month carries sufficient fuel for 70 days at 12¾ knots loaded speed, the daily consumption being 19 tons. Bunkering this supply takes but three hours.

## WHAT OLD SCOTCH SAYS

In the October issue of "International Marine Engineering" "Old Scotch," the well-known contributor, makes the following statement:

> "We must economize in the use of oil for marine propulsion by using internal-combustion engines. If the writer can read the signs of the times correctly, we are on the eve of a great construction of motorships in this country. We are sadly behind our European rivals, but it is not too late to get into this new field, and we can profit by the experimenting of our rivals. Several of our large shipyards have been sending representatives on hasty trips to Europe to learn of the latest developments in this type of engines, and, if possible, to secure the American rights for manufacturing the most successful types here."

Furthermore, referring to Section Eleven of the new Merchant Marine Act, he states that the definition "the most modern, the most efficient and the most economical" machinery should imply that a number of Diesel-engined ships may be constructed by means of this method of Government aid.

## WHAT "MARINE JOURNAL" SAYS

(From the issue of October 9th, 1920)

"Without a doubt, one of the most vital questions in the shipping business today is that of developing a dependable and flexible internal-combustion engine to take the place of the steam-engine, whether of the reciprocating or turbine type. Engineers are unanimous in stating that we are at a parting of the ways in the matter of propelling ships. *The steam-engine without question is on the decline.* Just what producer of energy can be developed to combine all its good points and leave out most of its faults, is the question of the hour among progressive marine engineers. The trend of advanced thought on the subject is in favor of the Diesel-type engine, and of the ship equipped with this type, called for the sake of euphony the motorship."

## OUR MERCHANT MARINE

*Admiral W. S. Benson, at Chicago, October* 15, 1920.

Plain speech harms only those who are afraid of the truth. I have always maintained that whenever you let in the sunshine truth reigns supreme. This is true now—it was true in the past.

What American worth his salt will stand up in public and say our merchant marine is a menace to this nation or any other? Yet we find men hid behind corporate names and organizations who have the audacity to create such an impression. But when you tear off the mask you find that these same men are basking in the favor of foreign shipping interests or have hopes in that direction. Now and then their efforts to muddy the waters succeed to the extent of influencing honest opinion against the Shipping Board's policies which aim to upbuild a permanent merchant marine.

Our shipbuilding is in rivalry with no one. We were content to see our commerce carried in the bottoms of other nations. It was not until urged by our allies to engage in shipbuilding on a stupendous scale that we attempted to rehabilitate our fast diminishing fleet. A world emergency—the civilization of the world was at stake and we were told that ships and more ships were the crying need. The cry that went out for ships we answered and the noble response of our citizens who bought Liberty Bonds to finance the building of these ships aroused the admiration of the world. The records of our shipbuilders stirred the imagination of all. It was real teamwork and history in the making. Our workmen broke world records in ship construction and riveting rivalry speeded up shipbuilding. America applauded these efforts. Then came the armistice. A new set of problems were before us. Mr. Hurley was brave and farsighted when he cut down our construction program to a point where we saved more than $600,000,000 by the cancellations he effected. It was no easy task and you men of large affairs know what problems must have confronted the Shipping Board when it saw the need of shutting off many shipbuilding activities. But that is now history. It is what we have before us today that you are most interested in.

## ENTIRE SHIPYARD EQUIPMENT ON MARKET

We have been advised that the National Ship Supply & Machinery Company, Woolworth Bldg., New York City, —a newly organized company, have begun operations by buying complete from the U. S. Shipping Board the supply base and shipyard at Baltimore known as The Maryland Shipyard & Supply Base. This includes all property, land and materials, and the new owners will dispose of the same in any amount from a single item to as large a quantity as desired. This opens up a big field for securing rapid supplies and will be appreciated by many firms whose requirements have not been for sufficient quantities to permit them to commence negotiations, or offer bids to the Shipping Board, who, on account of a recent decision, are selling all of their yards complete.

The above stock is very complete and consists of everything for shipbuilding, but operating equipment and is U. S. Government & Lloyd's inspected. The yard contains 2500 feet of rail siding, 4 miles of track, warehouses, loading platforms, etc. One deck 1000 feet long, 2800 feet of water frontage with a depth of 22 feet. The officers of the company are Albert A. Rosher, President, Wm. Rosenfield, Secretary, Fred Mayer, Treasurer, and Mr. John F. Connell, Vice-President and General Manager.

## AKERS TO BUILD NEW DIESEL PLANT

The Akers Mek Verksted, of Christiania, Norway, propose to erect new marine Diesel-engine works on a site adjacent to their shipyard, that they purchased for Kr. 2,500,000. The Akers Co., are holders of a Burmeister & Wain Diesel-engine license, and have three large motorships to their credit, including the "Bayard" of the Fred Olsen Line.

## THE WHITE MARINE DIESEL ENGINE

The annual report of J. Samuel White & Co., Ltd., East Cowes, England states that—in view of the large demand for Diesel engines for land and marine purposes, they are building an experimental single-cylinder engine to their own designs, with special patented features, which they believe will give considerably more power than other engines of the same bore and stroke, and at practically the same manufacturing cost.

## PALMERS ADOPT CAMMELL-LAIRD FULLAGAR LICENSE

"The Diesel engine is rapidly coming to the front and we have taken out a license to build the Cammell-Laird Fullagar Diesel engine as it is necessary that we should be in a position to meet the demands of shipowners for this type of propulsion"—stated G. Muir Ritchie, Chairman, Palmers Shipbuilding & Iron Company, Ltd., Newcastle-on-Tyne, England, to the shareholders at the 55th annual meeting held on Sept. 24th.

## IMITATION IS FLATTERY

It was only to be expected that the world-wide popularity and remarkable success of "Motorship" would produce imitators, but we did hope that there were limits to which copyists would go even tho' the same may be complimentary to us. But, we are wrong it appears, as we recently received a copy of a French publication which is as exact a copy of the striking and well-known cover of "Motorship" as could possibly be, the same color scheme of buff, red and black being adapted, even the title word being offset to make the name stand-out more prominently, as introduced by this publication about eighteen months ago. The present cover-design was first adopted by "Motorship" in January, 1918, being an improvement on the somewhat similar design previously used, and we regard this French magazine as an example of blatant plagiarism, and we are at once taking legal steps to protect our copyright and trade-mark, particularly as "Motorship's" has an international circulation including France. The French magazine is named "Motor" and deals with various types of motive power including marine oil-engines.

**An example of blatant plagiarism by a French publishing house. The color scheme also is exactly the same as "Motorship" cover.**

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# Abroad the "Athene" on Her Trial Trip

*An Account of an Interesting Experience*

BY S. SNUYFF

MUCH has changed in a few years! Not long ago a trial-trip on board a sea-going motorship was a peculiar event in one's life. One climbed aboard with a feeling of awe, and could not help being amazed to see the Diesel engines turn and propel the ship. Every moment one expected a loud report and the sight of a cylinder-head or an air-vessel as a little black spot in the sky. The engine-room was crowded with nervous souls, shaking hands when the engine would reverse, and nearly embracing each other when it would run ahead again.

Nowadays the engines are the last things to bother one on a motorship's trial-trip. The weather, the table, the wine, not to speak of pleasant fellow-passengers often are of widely greater importance to the visitor. When the telegraph-bell in the engine-room rings for reversing, one still pushes the button of his chronometer from pure custom, reads the seconds, pushes back and forgets the number!

The "Athene" is a cargo-vessel of 6500 tons d.w.c., built to the order of Dampskibs-Aktrieselskabet "Ada" of Kragero (Norway) at the yard of the Naamlooze Vennootschap Werf Rijkee & Co., near Rotterdam, and engined by Werkspoor. The propelling-set consists of two Werkspoor-Diesel engines of 1400 I.H.P., each with a normal speed of 125 R.P.M., a cylinder diameter of 560 mm (22.047 ins.) and a stroke of 1000 mm (39.370 ins.). All auxiliaries are worked electrically, current being generated by *three* four-cylinder high-speed Diesel-engines. Both main and auxiliary Diesel-engines are built on the four-cycle principle, as is the practice with Werkspoor.

Her leading dimensions are as follows:

| | |
|---|---|
| Displacement (loaded) | 9,600 tons |
| Displacement (light) | 3,100 tons |
| Deadweight capacity | 6,500 tons |
| Fuel-capacity | 900 tons |
| Power | 2,800 I.H.P. (2,000 Shaft h.p.) |
| Engine-speed | 125 r.p.m. |
| Daily Fuel-consumption | 9 tons |
| Ship's speed (loaded) | 10½ to 11 knots |
| Length (B.P.) | 375 ft. |
| Breadth (moulded) | 51 ft. 3 ins. |
| Depth (moulded) | 34 ft. |
| Draught (mean loaded) | 23 ft. |
| Bore and stroke of cylinders, | 22.047 ins. by 39.370 ins. |
| Length of engine-room | 50 ft. |

At 9:30 a.m. July 29th, the "Athene" left Rotterdam harbor and proceeded through the "New Waterway" to the North Sea. All went well, and no faults developed with the ship or engines until the anchor was lowered to test the electrically-driven windlass. The handling of it did not operate as quickly as was desired. There developed different circumstances of mechanical and electric character that prevented the electric-motor driving the windlass so that it would operate properly. When this trouble had been detected and corrected the motor handled the anchor without further hold-up.

Meanwhile, this event had caused a delay that had a confusing effect on the trial program. By the time the ship re-started the tide had changed and she had to struggle against a strong current that increased the delay to a great extent, despite the Diesel engines working steadily at a speed that enabled the "Athene" to easily overtake a freight-steamer of about the same size.

About half-way through the "New Waterway" the ship suddenly refused to answer the rudder, and seemed to seek a course through the mellow pastures along the river side. Obviously there was something wrong with the rudder system, but the pilot lost no time in grasping the telegraph-handles in order to steer the vessel with the engines. This gave an unexpected and unprepared opportunity to show the manoeuvring qualities of the Diesels under their new type of reversing mechanism. Indeed they answered so promptly and quickly to the commands of the bridge, that the pilot succeeded in restoring the right course in time, and maintained it during the period necessary for finding and remedying the fault in the steering-system, which proved to be in the electric part too. The rudder of the "Athene" is actuated by a Hele Shaw-Martineau mechanism, which system is familiar to many readers of "Motorship." It appeared that the electric motor had stopped for a moment.

In this case the excellent manoeuvring capacities of the engines had saved us from an anchoring in the middle of the crowded river; indeed this event outwardly passed-by as if nothing had happened.

This impression advances a question that is of wide importance to motor-shipping. Builders have to account for the safe working of auxiliaries, especially the anchor-windlasses and steering-gear. This is an indispensable condition for successful shipping, and when electric drive is preferred from an economical point of view it has to be kept in mind that the design and installation of electrical machinery on board ship required much more care and skill than is the case with steam or hydraulic power. It has to be especially borne in mind that deck-hands are not electro-mechanics and that nothing can be left to the skill of the operating-crew. A steam-winch will turn if there is steam, and the operator can immediately ascertain if there is any or not. The electric-motor, however, may have a lot of reasons for not functioning even if there is current. A fuse may have blown out, an automatic switch may have fallen out, a wire connection may have loosened, troubles of different character may have taken place in the controller, the switch and the motor itself; the operator may have forgotten to turn the switch, etc. All such conditions do not manifest themselves at once, thus enforcing a lot of thinking and searching.

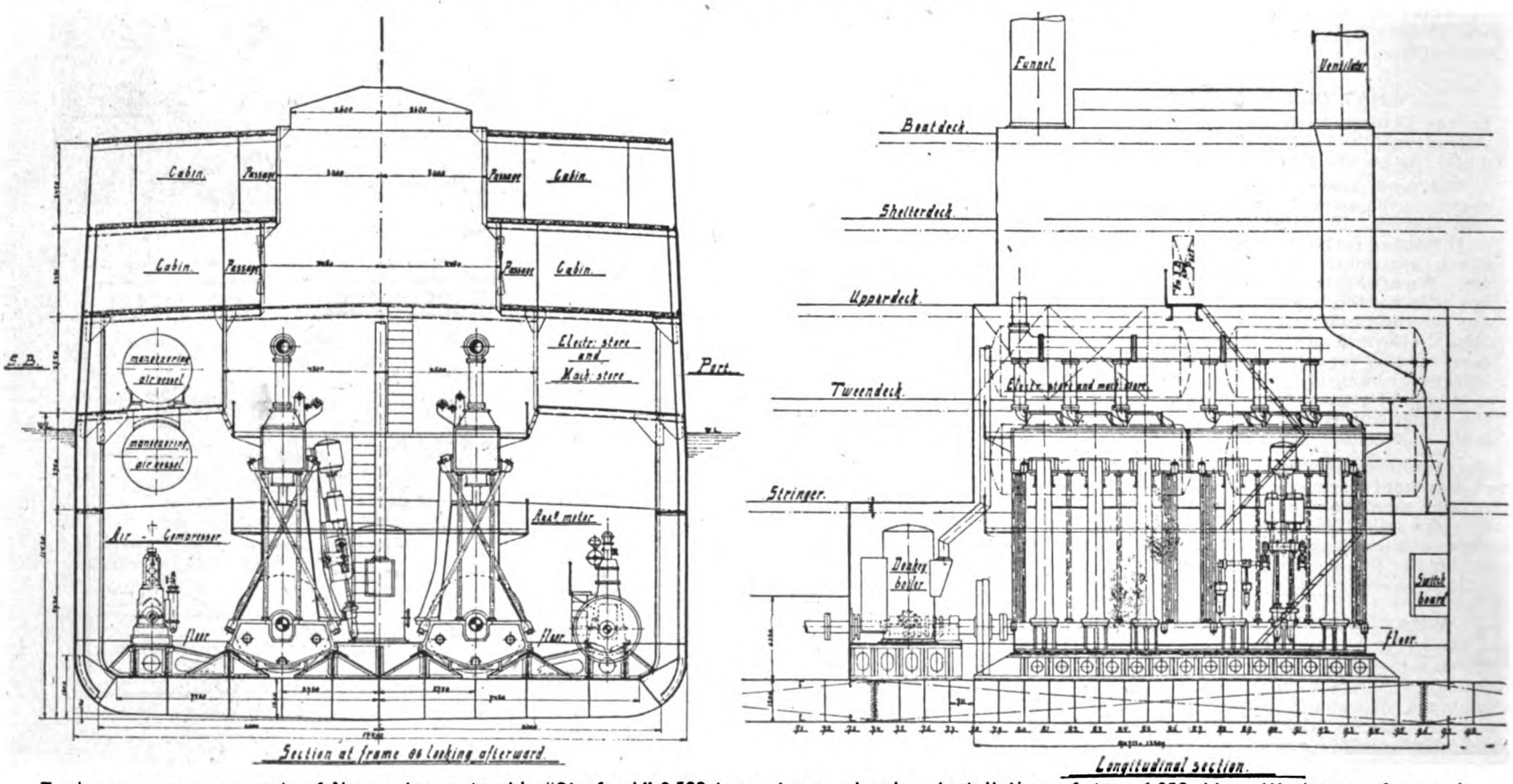
A successful application of electricity as an exclusive power medium on board requires in the first place the earnest collaboration of the electrical-engineer with the mechanical-engineer, shipbuilder and shipping expert, to ascertain the proper design of motors, accessories (controllers, switches, fuses, connections, etc.) wires, mechanical structures, safety appliances, etc. Then it will be necessary to have a very accurate inspection during construction and when finished. Also knowledge of electricity by the engineers-in-charge is an important item.

As the importance of electrical-transmission grows with the advance of motor shipping it is to be hoped that the question of safe and "fool proof" working of auxiliaries will have the keen attention of all concerned.

Though the electrical occurrences thus formed the greater part of the experiences gained on this trial trip we cannot close this report without mentioning the remarkable smooth and silent running of the Diesel-engines. As regards the absence of noise we may mention that with the new Werkspoor-Diesel engines the suction-valves draw the air from a chamber in the cast iron cylinder-beam, to which the valve casings are connected by means of elbows. With the system adopted all noise from air-suction is eliminated and it is hardly possible to hear the engines anywhere beyond the engine-room.

## EXTENSION OF NORDBERG PLANT

A 200 ft. by 180 ft. extension to the main Diesel-engine constructional shop and bays of the Nordberg Manufacturing Company's plant, Milwaukee, has just been completed. One of the largest engines now going through the shop is a 2000 b.h.p. Diesel oil-engine of the two-cycle type. Prior to the erection of the new addition large castings after being machined were placed on the erecting floor. This handicapped the erectors by limiting the available space for erecting purposes. Under the new arrangement, the machined castings will be placed in the new addition until wanted on the erecting floor. An extension of the office building is also being rushed to completion. It will provide large private offices and more space for the drafting-room.




**Engine-room arrangements of Norwegian motorship "Storfond," 9,500 tons d.w.c., showing installation of two 1,950 i.h.p. Werkspoor four-cycle Diesel engines.**

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# New Double-Acting, Two-Cycle Marine Diesel-Engine

*Details of an American Engine, Completion of Which Was Halted by the War*

BY M. GOLDBERG

(Chief-Engineer Manning, Maxwell and Moore Muskegon Works)

For the propulsion of vessels of moderate power requirements, Diesel engines of the two and four cycle types are available. To anticipate the demand for larger power units, efforts on a big scale are being made by European builders and the solution of this problem is still open. As with the moderate power units, American builders are not taking any leading part and apparently are contenting themselves with waiting for European builders to control a prospective profitable field and later, in great haste, to pay handsomely for constructional licenses or be content with the undignified product of a copy. We have so many licenses of foreign Diesel-engines that it may, perhaps, be timely to ask our own engineering profession for a little originality in this field and to expect a product that will meet our own operating ideas and conditions. Even in our discussions of the merits of the two and four cycle types, we find the strong influence of European engineering thought. In these discussions a rather strong emphasis is put upon the advantage of a few per cent of fuel-consumption. But it has been our experience to attach greater value to mechanical simplicity and the reduction of parts subject to wear and requiring attention of the operator. Occasional repairs and shut-downs will more than counter-balance a higher fuel-consumption of a few per cent.

The demand of the future for large power units will lead us to the two-cycle double-acting Diesel engine as it cannot be considered good practice to continue to increase the bore and stroke of the four-cycle type and the multiplication of the number of cylinders is still less desirable. However, with our two-cycle double-acting type of the future the problem cannot be considered solved unless we concentrate upon mechanical simplicity even at a slight sacrifice of efficiency. For moderate power unit our present design may well be satisfactory, as four-cycle as well as our two-cycle machines, but for larger units we shall have to come to a radical departure in order to get a practical installation for Marine service.

With the aim of large units and extreme mechanical simplicity in view I now offer the following type of engine for consideration.

Before the entrance of the United States into the world war, a horizontal stationary engine of this type was well under way at the plant of a well-known American firm, but large war orders compelled the discontinuance of the internal-combustion engine line for an indefinite period.

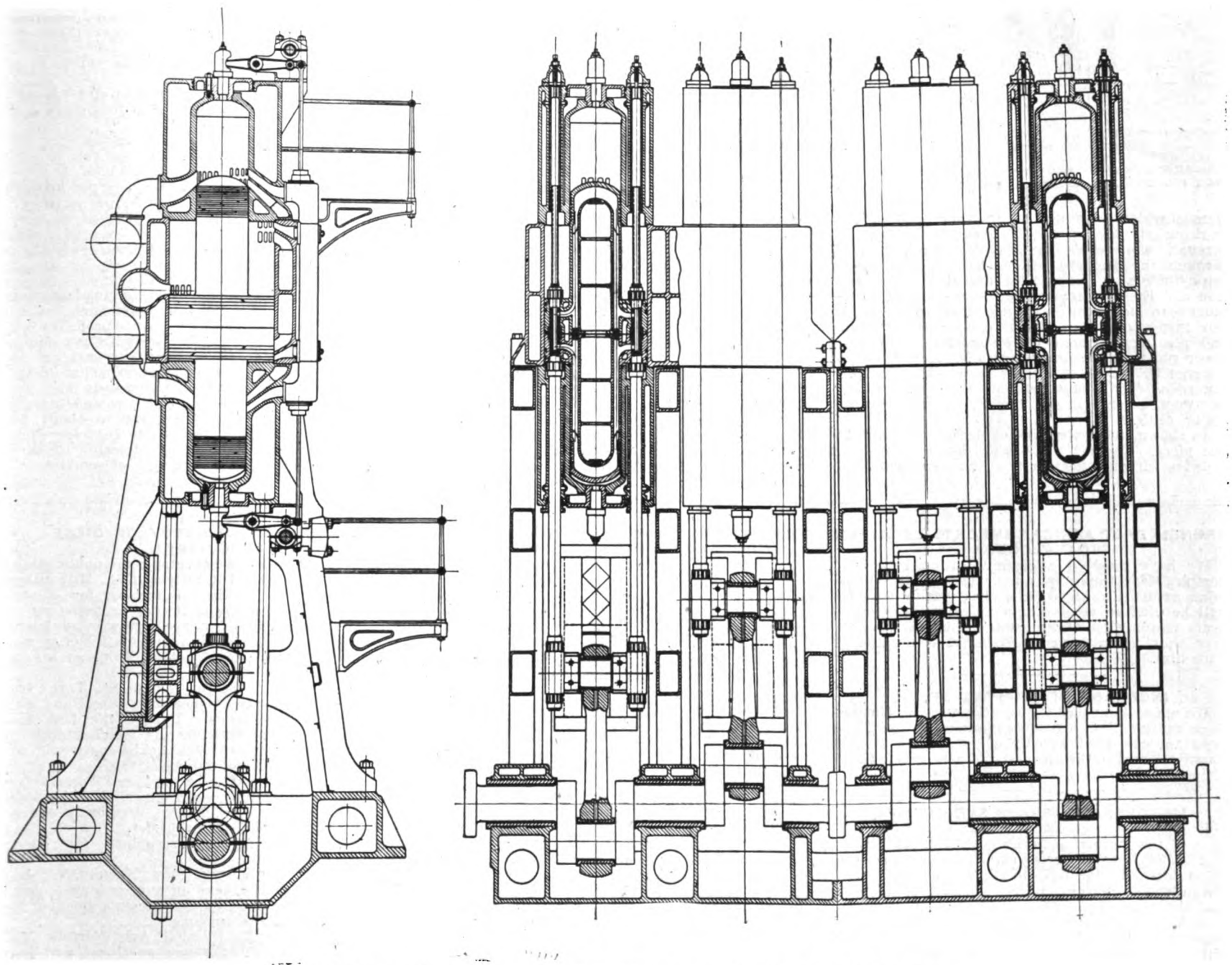
The engine is of the two-cycle double-acting type with a double-acting scavenging-air pump between the working cylinders. Two piston-rods pass through water-cooled sleeves within the lower working-cylinder jacket and outside of the compression-chamber transmitting the work to the crank-shaft by means of a cross-head and connecting-rod.

The principle of the two-cycle ported type engine is sufficiently known to need no further explanation, but the method of scavenging and surcharging the working-cylinders deserves description. In order to attain mechanical simplicity the scavenging-pump is designed with suction and discharge ports. A single row of ports in the middle of the pump-cylinder serves as suction-port for either end of the pump. By the use of the crank end of the pump for scavenging the head end working-cylinder, and vice-versa, pump discharge-valves are not required. The scavenging-pump may be described as a two-stage pump, the first stage serving for scavenging and the second stage for surcharging the working-cylinder and also as first stage for the injection-air compressor.

With this arrangement, the low pressure injection-air cylinder will not require over 70 per cent over its displacement when using air of atmospheric pressure. The air-pump piston closes the scavenging-ports ahead of its dead center for a distance, preventing the pump on its return stroke to fill again from the working-cylinder.

In other words, the scavenging-port of the pump cylinder is not uncovered again until the working-piston has covered the scavenging ports of the power cylinder. The pump-piston having delivered the scavenging-air into the jacket of the pump-cylinder serving as a receiver, and closed the pump-scavenging ports, a second stage of compression takes place, the air being forced through a couple of plate-valves and held in a chamber formed between these plate-valves and the mechanically operated surchaging-valve of the working-cylinder.

From here the air is also drawn on at the suction stroke of the injection air compressor. As



the Goldberg double-acting engine. General arrangement and sectional drawings of

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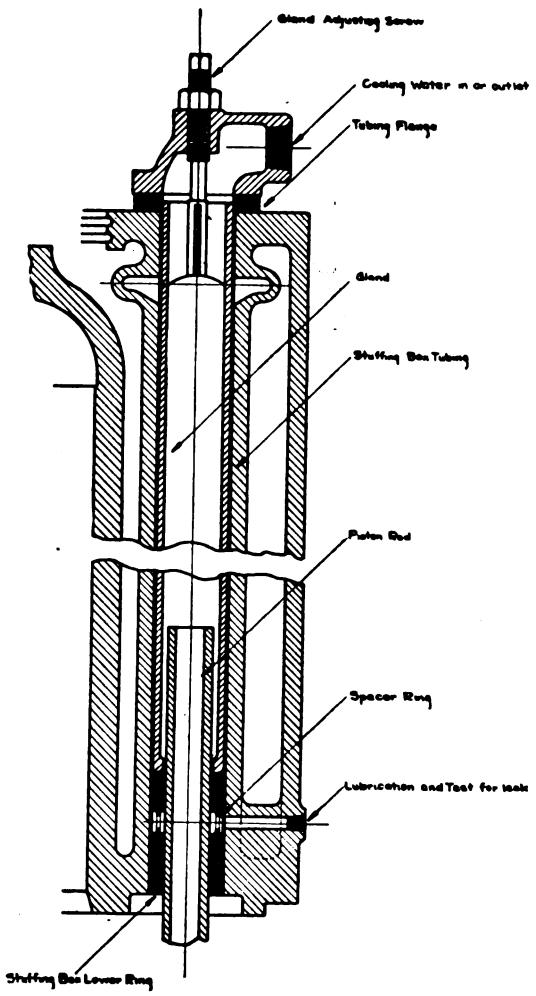
illustrated in the accompanying drawings, the pump-cylinders are cast in pairs and form a cylinder beam. The jackets of these cylinders, as mentioned above, serve as air-receivers for scavenging.

These pump cylinders rest on cast iron "A"




ENLARGED SECTION OF STUFFING BOX FOR PISTON COOLING ARRANGEMENT

frames which take the compression load of the working-cylinders. Four tension-rods extend through the whole system of cylinders and through the box-type bed-plate. The jackets of the cylinders as can be seen, are of a square section and the four tension-bolts are all that is required to hold the working-cylinders in place. For inspection of the lower cylinder and piston and also replacement of piston-rings, the four lower rod nuts are unscrewed and the cylinder is lowered by means of clamps fastened to the piston rods. The piston-rod nuts at the cross-head are then unscrewed and the piston raised to its upper center.

As shown, the cylinders and jackets are cast in one piece. The cylinders are allowed to expand endwise without affecting the structural length of the engine. The same methods can be employed also when using a separate cylinder-liner. Attention may be called to the fact that there is no high-pressure joint with this construction and only a small high-pressure gasket, say, of 6 in. to 9 in., depending upon the size of the engine is employed for the cylinder end casting which contains the fuel and starting valves. This casting is bolted to the cylinder-liner and passes through the jacket by means of rings or perhaps, a stuffing-box with a gland.

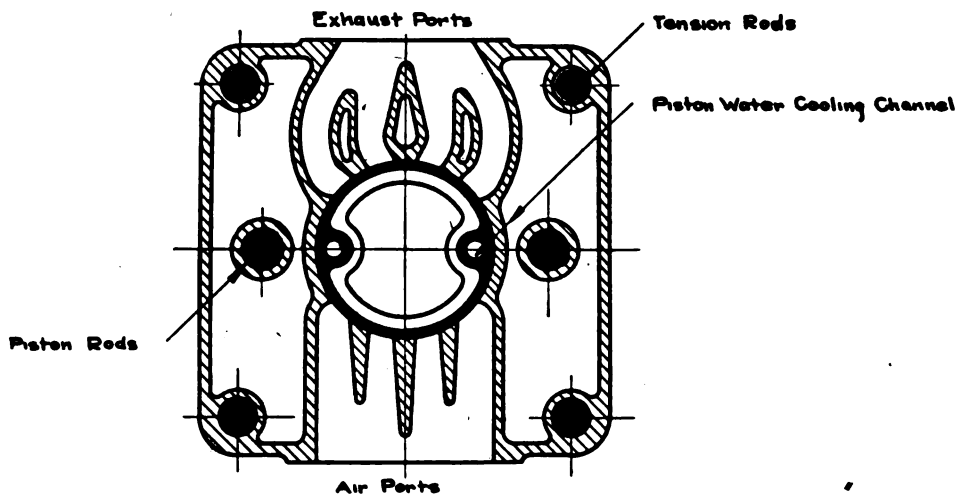
The regular and simple form of the combustion-chamber with its excellent cooling should meet the experience for good combustion and should eliminate any possible chances for cracking this part of the working-cylinder as experienced with the usual construction of cylinder-heads. The sleeves for the piston-rods are cast with expansion joints and surrounded by water. The sleeves of the upper cylinder serve for the water-cooling arrangement of the pistons.

For the cooling of the pistons, the piston-rods are extended into the upper cylinders, are drilled as shown in our drawing, one rod serving for water intake and the other for water outlet. The stuffing-boxes proper for these sliding pipes consist of a light tubing with a collar at the bottom extending to the lower end of the cylinder casting. The packing is held between the lower collar and the gland in the form of a tube. The packing can be taken up by means of a set screw as shown on top of the inlet and outlet ells and for renewing the packing, the whole stuffing-box can be withdrawn. A metallic ring placed between the packing sections and a hole leading to the outside of the cylinder may be provided for lubrication and testing of the stuffing-box for any leak.

With this arrangement of the stuffing-boxes, the rigid sliding-pipes and the straight line of piston travel, there should not be any trouble with the piston-cooling system, and most important, no lubricating trouble on account of leaking stuffing-boxes contaminating the oil in the crank-pit, as is often the case with single-acting engines.

With the double piston-rod arrangement, we have not only succeeded in getting a proper combustion-chamber, eliminated piston rod trouble through the hot flame of combustion, but also accomplished a great saving in the construction of the connecting-rods. Our cross-head proper consists of a simple steel-forging to which the cross-head shoes are fastened in a conventional way, but we have now departed from the very expensive fork-type of marine rod and the saving in this case is worth while.

At a first glance it may appear that the moving parts are rather heavy. Actual investigation of the matter has shown that the weights do not exceed those of a double-acting tandem gas-engine and with the high compression on either dead-center the weights are rather of benefit, reducing the initial working load of the cylinders on the piston-rods, connecting-rod and all bearings. Crank-effort curves demonstrate that these engines will run smoothly at a much higher rate of speed that the single-acting type with much lighter moving parts.




SECTION THROUGH POWER CYLINDER

It may, perhaps, be interesting to give approximate dimension of a four-cylinder 2000 shaft H.P. engine of this type, namely:—

| | |
|---|---|
| Bore | 22 inches |
| Stroke | 33 inches |
| Speed | 120 R.P.M. |
| Piston-speed | 660 feet per minute |
| Shaft M.E.P. | 66 lbs. per sq. in. |
| Overall length, including flywheel, thrust block and air compressor | 40 feet |
| Overall height form center line of shaft | 26 feet |

A shaft M.E.P. of 66 lbs. per sq. in. is a very conservative figure. The low piston-speed of 660 feet per minute was selected with propeller efficiency in view. A shaft M.E.P. of 66 lbs. per square inch can be obtained without surcharging the cylinders and the great overload capacity of this type of engine for forced runs of vessels may well be of great value. With surcharging and increasing the speed of this engine, say to about 160 R.P.M., we can obtain 3000 shaft H.P. for short periods, though it may not be advisable to carry this load through continuous days of service.

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### FRENCH EAST AFRICAN IMPORTER DESIRES CATALOGUES

We have received a communication from Mr. Joseph Mas, importer and exporter, of Duala (Cameroun) French West Africa, stating that he will be glad to receive catalogues and prices on products for West African Colonial trade. We suggest that firms interested should communicate with him.

### INCREASE OF CAPITAL STOCK

We understand that the capital stock of Thomas Fleming Day., Inc., marine equipment dealers, has been increased to $100,000.00. Our old friend, Captain Thomas Fleming Day is president of this company.

### MOTORSHIPS VERSUS STEAMSHIPS

Recently we gave details of the successful voyages of the motorship "Ansaldo San Giorgio I, II, and IIIB." We also referred to the fact that the ships "Ansaldo San Giorgio IV, V and VI," are all steam-turbine driven. In this connection we note that the "Ansaldo San Giorgio IV" recently pulled in at Balboa, Canal Zone, for boiler and other machinery repairs. This rather contrasts with her sister motorships, which have done such valuable work without any machinery repairs.

### CONVERTED STEAMERS OPEN NEW MOTORSHIP SERVICE FROM PHILADELPHIA TO NORWAY

A motorship service between Philadelphia and Norwegian ports has been established by S. O. Stray & Co. of New York and Christiania. The three Diesel-driven vessels to be placed on this route are the ones which they recently purchased from the Norwegian Government for about $240.00 per d.w. ton. They are single-screw ships of 6,500 tons converted from steamers and were originally known as the "Pangan," "Bandon" and "Chumpon." Then their names were changed to "Folkvard," "Lidvard" and "Landvard." by the Norwegian government. Recently Messrs. Stray & Co. again changed the names to "Songdal," "Songvar" and "Songvond."

### POLYTECHNIC MARINE ENGINEERING CLASSES

For young men seeking licenses from the U. S. Steamboat Inspection Bureau a course of instruction on the operation of marine Diesel engines is now being prepared by the Poltyechnic Institute of Brooklyn, N. Y. The course will be given by Lieut. M. T. Grubham who has had eight years practical experience in the operation of Diesel-engines in the U. S. Navy.

### MOTORSHIP'S REGISTRY OF DIESEL ENGINEERS

**(Additional names are acceptable for publication)**

*Wm. A. Campbell*, 184 Fifteenth St., Milwaukee, Wis., holds chief-engineer's licenses for 750-ton motorships and unlimited license as assistant-engineer of motorships. Served in war as Lieut. Engineer of Naval Reserves with duties of motorboat inspector and was 1st Asst. Engineer on the S. S. "Celtic."

*Nevin F. Hench*, 261 So. George St., York, Pa., has had ten years experience with Diesel and surface-ignition oil-engines. During the last two years has been chief-engineer in merchant-marine South American trade. Holds chief-engineer's unlimited license for motorships.

*G. E. McKenzie*, U. S. S. R-4, c/o Postmaster, N. Y. C., has had three years experience Diesel-engine operation in U. S. Navy. Previously served his time on outside as machinist. Has chief-engineer's license from Government for ocean waters.

*A. B. Krest*, 728 Marshall Ave., Norfolk, Va., has had five years experience on surface-ignition and Diesel engines. Has chief-engineer's license for motorships of any gross tons.

*Jesse B. Evans*, 728 Marshall Ave., Norfolk, Va., has had five years experience on Diesel and surface-ignition engines. Has chief-engineer's license.

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# Motorships vs Steamships

## *Comparative Operating Expenses and Earnings of Cargo Vessels*

PART III

BY CHARLES E. LUCKE

*Professor Mechanical Engineering, Columbia University and Consulting Engineer, Worthington Pump and Machinery Corporation*

(*Continued from page* 910, *October issue*)

*Fuel expense* is partly a matter of fuel-consumption determined in Table V., but quite as much a matter of fuel price. Fuel-oil prices are very uncertain, varying not only in different ports for the same grade of oil and with appreciable differences appropriate to grades (the lighter being higher in price), but at any one place prices fluctuate from day to day. About the only stable element of oil prices is the general upward trend that has prevailed for several years and which, according to present indications, will continue at least for the near future.

The range of variation in prices in different world ports for one set of figures for 1919 was from $0.80 per bbl. minimum at Gulfport to $10.00 per bbl. maximum at a Chinese port, and the bulk of the figures are between $1.00 and $4.00 per bbl. As it is necessary to adopt a price to complete the estimate of expenses of operation, a round figure of $3.00 per bbl. is selected as a fair value for the present and immediate future for 16° Be oil for the steamship boilers and $3.50 for 22° Be oil for the motorship engines, retaining the usual excess over the former, which is about 15 per cent. These prices correspond to $3.00 × 6.67 = $20.01 per ton for 16° Be oil, and 3.50 × 6.95 = $24.32 per ton for 22° Be oil. On these figures the fuel expense per trip and per year is worked out as in Table X. for three typical voyages:

It will be noted that the very much lower fuel-consumption of the motorship is responsible for a big margin of difference in fuel expense, even if the more expensive grade of fuel is selected as a matter of convenience. Thus, for the shortest of the three voyages, that to Liverpool, there is a saving of $67,500 per year by the motorship against the steamship expense of $111,500; for the medium voyage, that to Buenos Aires, the motorship saves over $83,000 per year against the steamship expense of over $143,000 per year. These substantial savings overbalance all the excesses of fixed annual charges by very considerable margins and are the main factors in the general overall commercially economic superiority of the motorship. Of course, the lower fuel prices will reduce this margin, but will not eliminate it until fuel prices are lower than they will ever be except possibly at the producing points, or materially less than $1.00 per bbl.

*Cargo handling* expense is to be based on an estimated rate per ton handled, each ton being handled twice, once in loading and again discharging at another port, so the rate must be the average for all ports. While the rate will be determined in specific cases by handling facilities, labor wage rates, and efficiency of the labor, it is sufficient for present purposes to take a flat fixed rate of $2.00 per ton, as the rate will be the same for both ships and will not materially affect the comparison of the types. On this basis the figures of Table XI. were computed from the figures on total cargo from Table VI.

Service expenses are obtained in Table XIV. by adding all the separate items for each voyage.

*Total* expense of all kinds is summarized in Table XV. by adding together the totals of fixed annual expense, Table IX. and those of service expense, XIV.

*Insurance* is based on ship valuation, and the rates per voyage depend on the voyage, which, of course, are variable, depending partly on hazard and partly on commercial conditions. Omitting such special risks as war and piracy, the rates used in Table XII. are reasonable possibilities and about in correct relative proportion.

Port charges, including wharfage and pilotage, are specific items for each port, depending on local conditions there, and are, of course, the same for both types of ship. The figures of Table XIII. are believed to be fair estimates.

4. *Cost of Cargo Transportation, Net Earnings and Investment Returns.*

By bringing together the items of cargo handled in Table VI. and the total expenses incurred, in Table XV., the transportation costs can be determined and this is done in Table XVI.

These costs per ton, per voyage, when compared with the freight rates of $11 per ton to Liverpool, $15 per ton to Buenos Aires, and $24 per ton to South Africa, indicate a good margin of profit even if the rates were considerably reduced. In all cases also the motorship costs per ton-mile are appreciably lower by about 14 per cent, 20 per cent and 22 per cent in the three cases, which is an increasing per cent for the longer trip and smaller costs.

*Net earnings and investment returns* are summarized in Table XVII., the figures for gross earnings being transferred from Table VII., those for total expense from Table XV., and the difference in net earnings per year computed in terms of per cent return on the investment.

These figures of net return on investment are all favorable to the motorship, and more so as the length of the voyage is greater. Comparing the net returns directly, the motorship yield is for the three voyages, Liverpool, Buenos Aires and South Africa, 1.26, 1.48 and 1.45 times those for the steamship. These differences demonstrate clearly the necessity of such calculations as these to determine the most profitable routes for motorships as compared with steamships.

Another basis of comparison of some merit is the excess of net earnings of the motorship, on the excess investment. This investment excess is $1,950,000 — 1,800,000 = $150,000. The excess of net yearly earnings of the motorship for the three typical voyages in order is $119,912, $192,961 and $307,710. These net yearly returns represent, per cent returns on the extra motorship investment of $150,000 of 82 per cent, 129 per cent and 205 per cent respectively, showing a uniformly increased return on the investment excess on the whole amount for the three voyages studied and increasing with length of voyage. Attention is again called to the case of bulk cargo, in which results are also favorable to the motorship, but omitted for the sake of greater clearness.

TABLE X
Fuel-Oil Expense

| VOYAGE | | STEAMSHIP OIL at 3.00 Bbl. 16° Be Trip | STEAMSHIP OIL at 3.00 Bbl. 16° Be Year | MOTORSHIP OIL at 3.50 Bbl. 22° Be Trip | MOTORSHIP OIL at 3.50 Bbl. 22° Be Year |
|---|---|---|---|---|---|
| New York to Liverpool and return 6,439 miles 5.3 voyages, year | Oil required, tons | 1,051 | 5,570 | 342 | 1,813 |
| | Fuel expense | $21,030 | $111,459 | $8,317 | $44,080 |
| New York to Buenos Aires and return 11,740 miles 4.1 voyages, year | Oil required, tons | 1,741 | 7,138 | 602 | 2,468 |
| | Fuel expense | $34,837 | $142,831 | $14,641 | $60,027 |
| New York to South Africa and return 16,000 miles 3.4 voyages, year | Oil required, tons | 2,298 | 7,813 | 810 | 2,754 |
| | Fuel expense | $45,983 | $156,342 | $19,699 | $66,977 |

TABLE XI
Cargo (deadweight) Loading and Discharging Expense

| VOYAGE | ITEM | STEAMSHIP Voyage | STEAMSHIP Year | MOTORSHIP Voyage | MOTORSHIP Year |
|---|---|---|---|---|---|
| New York to Liverpool | Cargo handled, tons | $17,680 | $93,704 | $19,030 | $100,859 |
| | Expense | 35,360 | 187,408 | 38,060 | 201,718 |
| New York to Buenos Aires | Cargo handled, tons | 16,120 | 66,092 | 18,450 | 75,645 |
| | Expense | 32,240 | 132,184 | 36,900 | 151,290 |
| New York to South Africa | Cargo handled, tons | 14,990 | 50,966 | 18,030 | 61,302 |
| | Expense | 29,980 | 101,932 | 36,060 | 122,604 |

TABLE XII
Insurance Expense

| VOYAGES | ITEM | STEAMSHIP $1,800,000 Trip | STEAMSHIP $1,800,000 Year | MOTORSHIP $1,950,000 Trip | MOTORSHIP $1,950,000 Year |
|---|---|---|---|---|---|
| New York to Liverpool and return Rate ½%, 5.3 voyage, year, 67 days | Insurance | $9,000 | $47,700 | $9,750 | $51,675 |
| New York to Buenos Aires and return, Rate 1% 4.1 voyage, year, 87 days | Insurance | $18,000 | $73,800 | $19,500 | $79,950 |
| New York to South Africa and return, Rate 1½% 3.4 voyage, year, 104 days | Insurance | $27,000 | $91,800 | $29,250 | $99,500 |

TABLE XIII
Port Charges, Wharfage & Pilotage Expense

| VOYAGE | STEAMSHIP Voyage | STEAMSHIP Year | MOTORSHIP Voyage | MOTORSHIP Year |
|---|---|---|---|---|
| New York to Liverpool, 5.3 trips, year | $8,000 | $42,400 | $8,000 | $42,400 |
| New York to Buenos Aires, 4.1 trips, year | $6,000 | $24,600 | $6,000 | $24,600 |
| New York to South Africa, 3.4 trips, year | $9,000 | $30,600 | $9,000 | $30,600 |

TABLE XIV
Service Expense

| VOYAGE | ITEM | STEAMSHIP Voyage | STEAMSHIP Year | MOTORSHIP Voyage | MOTORSHIP Year |
|---|---|---|---|---|---|
| New York to Liverpool and return | Fuel | $21,030 | $111,459 | $8,317 | $44,080 |
| | Cargo handling | 35,360 | 187,408 | 38,060 | 201,718 |
| | Insurance | 9,000 | 47,700 | 9,750 | 51,675 |
| | Port charges | 8,000 | 42,400 | 8,000 | 42,400 |
| | Total | $73,390 | $388,967 | $64,127 | $339,873 |
| New York to Buenos Aires and return | Fuel | $34,837 | $142,831 | $14,641 | $60,027 |
| | Cargo handling | 32,240 | 132,184 | 36,900 | 151,290 |
| | Insurance | 18,000 | 73,800 | 19,500 | 79,950 |
| | Port charges | 6,000 | 24,600 | 6,000 | 24,600 |
| | Total | $91,077 | $373,415 | $77,041 | $315,867 |
| New York to South Africa and return | Fuel | $45,983 | $156,342 | $19,699 | $66,977 |
| | Cargo handling | 29,780 | 101,332 | 36,060 | 122,604 |
| | Insurance | 27,000 | 91,800 | 29,250 | 99,500 |
| | Port charges | 9,000 | 30,600 | 9,000 | 30,600 |
| | Total | $111,763 | $380,074 | $94,009 | $319,681 |

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TABLE XV
Total Expense

| VOYAGE | ITEM | STEAMSHIP Voyage | STEAMSHIP Year | MOTORSHIP Voyage | MOTORSHIP Year |
|---|---|---|---|---|---|
| New York to Liverpool and return, 5.3 voyages, per year | Fixed Annual... | $56,484 | $299,365 | $57,972 | $307,252 |
| | Service..... | 73,390 | 388,967 | 64,127 | 339,873 |
| | Total..... | $129,874 | $688,332 | $122,099 | $647,125 |
| New York to Buenos Aires and return, 4.1 voyages per year | Fixed Annual.. | $73,017 | $299,365 | $74,939 | $307,252 |
| | Service..... | 91,077 | 373,415 | 77,041 | 315,867 |
| | Total..... | $164,083 | $672,780 | $151,980 | $623,119 |
| New York to South Africa and return, 3.4 voyages; per year | Fixed Annual.. | $88,048 | $299,365 | $90,368 | $307,252 |
| | Service..... | 111,763 | 380,074 | 94,009 | 319,681 |
| | Total..... | $199,811 | $679,439 | $184,377 | $626,933 |

TABLE XVI
Cost of Transportation of Cargo (deadweight)

| VOYAGE | ITEM | STEAMSHIP Voyage | STEAMSHIP Year | MOTORSHIP Voyage | MOTORSHIP Year |
|---|---|---|---|---|---|
| New York to Liverpool and return, 6439 miles | Cargo, tons..... | $17,680 | $93,704 | $19,030 | $100,892 |
| | Cargo 1000 ton-miles | | | | |
| | Total expense..... | 129,874 | 688,332 | 122,099 | 647,155 |
| | Cost per ton..... | $7.34 | | $6.42 | |
| | Cost per 1000 ton-mile | 1.14 | | 1.00 | |
| New York to Buenos Aires and return, 11,740 miles | Cargo tons..... | $16,120 | $66,092 | $18,450 | $75,645 |
| | Cargo 1000 ton miles | | | | |
| | Total expense..... | 164,083 | 672,780 | 151,980 | 623,119 |
| | Cost per ton..... | $10.17 | | $8.23 | |
| | Cost per 1000 ton-mile | .87 | | .70 | |
| New York to South Africa, 16,000 miles | Cargo tons..... | $14,890 | $50,666 | $18,030 | $61,302 |
| | Cargo 1000 ton-mile | | | | |
| | Total expense..... | 199,811 | 679;439 | 184,377 | 626,993 |
| | Cost per ton..... | $13.42 | | $10.23 | |
| | Cost per 1000 ton-mile | .84 | | .64 | |

TABLE XVII
Net Earnings and Investment Returns

| VOYAGE | ITEM | STEAMSHIP $1,800,000 valuation Voyage | STEAMSHIP $1,800,000 valuation Year | MOTORSHIP $1,950,000 valuation Voyage | MOTORSHIP $1,950,000 valuation Year |
|---|---|---|---|---|---|
| New York to Liverpool and return 5.3 voyages per year | Gross earnings..... | $194,480 | $1,030,744 | $209,330 | $1,09,1449 |
| | Total expense..... | 129,874 | 688,332 | 122,099 | 647,125 |
| | Net earnings..... | $64,606 | $342,412 | $87,231 | $462,324 |
| | Investment Returns % per year.. | 19.0% | | 23.8% | |
| New York to Buenos Aires and return 4.1 voyages per year | Gross earnings..... | $241,800 | $991,380 | $276,750 | $1,134,675 |
| | Total Expense..... | 164,083 | 672,780 | 151,980 | 623,114 |
| | Net Earnings..... | $77,717 | $318,600 | $124,770 | $511,561 |
| | Investment Returns % per year... | 17.70% | | 26.25% | |
| New York to South Africa and return 3.5 voyages per year | Gross earnings..... | $357,360 | $1,215,984 | $432,720 | $1,471,248 |
| | Total expense..... | 199,811 | 679,439 | 184,377 | 626,993 |
| | Net Earnings..... | $157,549 | $536,545 | $248,343 | $844,255 |
| | Investment Returns % per year | 29.80% | | 43.32% | |

These comparative calculations for the operations of steamers and motorships are presented primarily to show that the motorship has decided advantages over the steamship on a purely commercial profit earning basis, when care is exercised in selecting suitable service conditions and a proper trade route. The selecton of proper conditions and the decision as to the commercial value of a motorship over a steamer cannot be made in a haphazard manner, and general overall figures are apt to be misleading, to say the least. There is only one way known to get at the facts, and that is the preparation of a carefully itemized statement, with each separate factor as accurately determined, as possible for the conditions to be met, and the object of the bulletin is to assist those interested by presenting these forms and tables.

An invitation is extended to all concerned to send in further data on any or all of these items, that will contribute to improvement of future estimates, both as to volume of data for all sorts of conditions, and the accuracy of the figures as derived from actual experience in ship operation.

### "ATHENE'S" MAIDEN VOYAGE

The 6,600 tons d.w.c. "Athene" has completed her maiden voyage to Montreal, Quebec, and returned. This vessel is propelled by two 1400 I.H.P. Werkspoor Diesel-engines. The daily fuel-consumption of the ship was only eight tons of fuel-oil on this voyage. Her owners are K. Salvesen and Company of Kragero, Norway.

### ANOTHER WERKSPOOR LICENSEE

We understand that the firm of J. Smits & Zonen, Kinderdyke, Holland, have taken out a license to construct the Werkspoor marine Diesel-engine, and will commence work on some engines for cargo motorships for the Otto & Thor Thoresen Line.

### NORWEGIAN PACIFIC LINE TO AUGMENT MOTORSHIP SERVICE

It is the intention of the Norwegian-Pacific Line —says the "Panama Canal Record," to considerably augment its motorship line between Norwegian and Continental ports.

### THREE 2,300 TONS MOTOR AUXILIARIES FOR OCEANA COMPANY

Recently the Oceana Shipping Co. (Denmark) took delivery of three auxiliary motorships of 2,300 tons d.w.c. We understand that they were built by the Sturhs Shipbuilding Yard at Aalborg. The managing-director, Mr. Swenson, states that these vessels have been found to sail as well as their steamers and with a corresponding profit.

### GERMAN MOTOR-DRIVEN TRAINING SHIP

Prior to the war the Hamburg-American Line built a large auxiliary sailing-ship fitted with a Tecklenborg-Carels two-cycle type Diesel-engine for the purpose of training engine-room crews and deck-officers. This vessel has been taken over by the British and is now in Scottish waters.

### MACHINE SHOP HOISTING HINTS

We have received an interesting illustrated booklet dealing with Chain Blocks and Trolleys for machine-shops as made by the Yale & Towne Manufacturing Company of Stamford, Conn. Also illustrated and described is their "Y" Spur-Gear Chain Plug, with which a load of one ton can be lifted easily and quickly by one man pulling but 82 lbs. on the hand chain. It is made in 17 sizes from ¼ to 40 tons capacity. Copies of this booklet may be obtained from the Yale & Towne Mfg. Company.

### AMERICAN ENGINEERING COMPANY

Through a misunderstanding the name of the American Engineering Co. of Philadelphia was included in the great American Shipping Combine referred to on page 603 of the July issue of "Motorship." We are advised by the American Engineering Co., that they are neither directly or indirectly connected with this Company so that there is no foundation for such a report. We gladly give space to this correction.

### R. D. KARR OPENS OFFICE

Richard D. Karr, Associate Member of the Society of Naval Architects and Marine Engineers, has opened an office at 81 Broad St., N. Y. C., for consulting and designing practice. Mr. Karr has been intimately associated with the progress of the marine oil-engine and motorships for several years, and through training and experience is well prepared to handle problems in the design, installation and repair of marine machinery and hulls. He holds operator's licenses for both steam and oil-engine machinery for ocean service and when the Editor of "Motorship" was in Europe he officiated as Acting-Editor. Since his graduation from Webb Institute of Naval Architecture in 1914, Mr. Karr's work has been an intimate and widely varied combination of sea, shop, drafting, estimating, hull erection and repair work. He is prepared particularly to assist in developing the growing interest in the marine Diesel-engine for all purposes.

### CONVERSION OF THE STEAM AND SAILING SHIPS "LADY CARMICHAEL," "MAORILANDS," "RENFIELD" AND "ELLENIS."

Among vessels built with steam power now being converted to economical oil-engine drive may be mentioned the old side-wheel steamer "Lady Carmichael," built in 1871 at Dumbarton, Scotland. She is now owned by Arthur Tate & Company, Ltd., Newcastle-on-Tyne, England, and is being equipped with twin 150 B.H.P. Vickers-Petter surface-ignition oil-engines. The vessel has a deadweight capacity of 520 tons.

Twin 220 B.H.P. Vickers-Petter surace-ignition oil-engines are being installed in the iron bark "Maorilands," built in 1876 and now owned by Arthur Tate & Company, Ltd., of Newcastle-on-Tyne.

Two Vickers-Petter oil-engines of the same power are also being installed in the two-masted barkentine "Renfield," owned by the same firm. The "Renfield" is an old vessel. built in 1895, and has a capacity of 1750 tons. The work of conversion is now bieng completed at the Mercantile Dry Dock, Jarrow, England.

The old Grecian 150 tons d.w.c. steamship "Ellenis" is being converted to motor power. Her new machinery will consist of a 450 B. H. P. Vickers-Petter surface-ignition oil-engine now completing at the makers' Ipswich Works.

### A NEW OIL STRAINER

Strainers are required on the suction and discharge lines of lubricating-oil, fuel-oil and quenching-oil systems, for the removal of solid foreign material in suspension.

For this purpose The Griscom-Russell Co., 90 West Street, New York, have placed on the market a new G-R Strainer. The body is constructed of cast-iron and the strainer basket of perforated sheet-steel and lined with wire mesh when the strainer is to be used on an oil line. It is of the single type and may be installed either as a single unit, or as the G-R Strainer Set. This G-R Strainer Set consists of two of these strainers connected, complete including two three-way valves and necessary connecting elbows, unions and nipples. This set permits the cleaning of either of the two units without interruption of the service.

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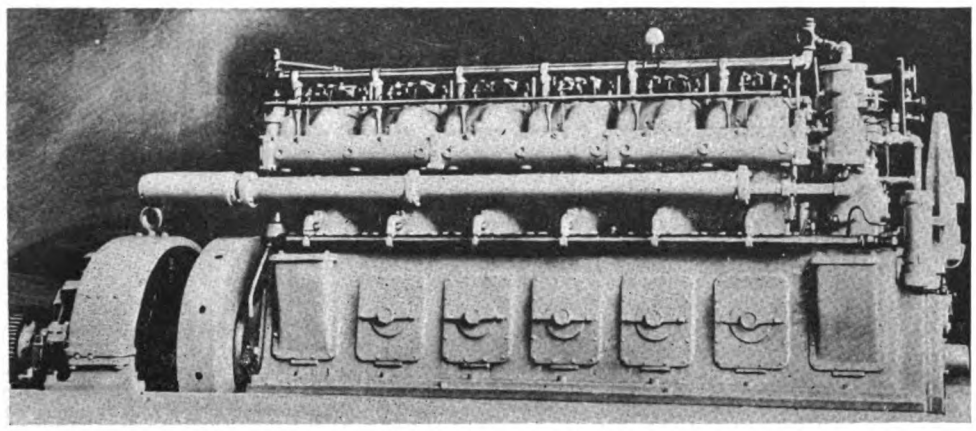
# Diesel-Electric Propulsion Versus Steam for Fire-Boats

## *A Discussion of the Various Classes of Power for This Purpose*

WILLIAM H. EASTON*

ATTENTION has been recently called to the fact that there are no fire-boats in our Southern ports. This is unquestionably a serious error of omission, for the fire-boat provides not only the most effective, but often the only possible, means of protecting shipping and water-side property; and it is easily possible for a single harbor conflagration to cause a loss that would be greater than the total cost of all the fire-boats now needed. Discussion of this subject is, in fact, unnecessary—everyone will agree that there should be at least one fire-boat in every port of importance; and since we have now reached a position where constructive work can once more be undertaken, a number of these useful vessels will undoubtedly be built in the near future.

This is, therefore, a good time to consider the equipment of these boats, for they should be modern in every respect and as efficient as it is possible to make them. Naturally the fire-boats now giving such good service will be carefully studied in planning the new ones; but they should not be copied slavishly, for marine-engineering has made rapid progress since the beginning of the war, and this is especially true of the main propelling machinery.



Winten Diesel-engine and Westinghouse electric generator-set

Five years ago reciprocating steam-engines alone would have been considered for the main drive of boats of this type, but to-day, four additional drives are available; namely, geared-turbine, steam-electric, Diesel-engine, and Diesel-electric. These new drives can be briefly described as follows.

The geared-turbine drive consists of a high-speed steam-turbine with a gear which reduces the turbine speed of about 3000 R. P. M. to the propeller speed of about 100 R.P.M. It is especially applicable to merchant-ships and is in use on several hundreds to-day.

In the steam-electric drive, one or more steam-turbines driving generators furnish electric power to drive motors directly connected to the propeller-shafts. This system is used on all of the latest U. S. battleships and is also considered ideal for very large express steamers.

The Diesel-engine, which is an internal-combustion engine using heavy-oil as a fuel, is becoming increasingly popular, because of its high fuel-economy. In the "direct" Diesel-drive, the engine is directly connected to the propeller-shaft.

The Diesel-electric drive is similar to the steam-electric, except that the electric-generators are driven by Diesel-engines instead of steam-turbines.

Of all these systems of propulsion, which is most suitable for fire-boats?

One of the chief features of a fire-boat's duty is to be always ready for instant service. Where any form of steam power is used—reciprocating-engine, geared-turbine, or steam-electric system—steam pressure must be kept up in the boilers at all times, which necessitates constant attention and causes large stand-by fuel losses. With either the direct Diesel or the Diesel-electric drive, however, the engines can be kept in constant readiness without the consumption of any fuel whatever. This eliminates the stand-by losses, and since furthermore, a Diesel-engine in operation consumes only about one-third the fuel required by the most efficient type of steam engine of the same power capacity, the saving in operating cost in favor of the Diesel-engine is obvious.

Hence in all probability, the majority of fire-boats built from now on will be driven by Diesel-engines. If steam is necessary for heating and other special purposes, it can be furnished by a small auxiliary oil-fired boiler, which can also take care of a small turbine-generator set for supplying electricity for lighting and for the limited power requirements of the boat when in port.

But which form of Diesel-drive is preferable, the "direct" Diesel or the Diesel-electric? To answer this question, we must examine further the service conditions of the boat.

Obviously one of the chief requirements of a fire boat is a high degree of manoeuvering power. When called to action, it must be able to dart across a crowded harbor, thread its way in among ships and boats of every size and in every state of confusion, place itself in the best position to reach the seat of trouble, and then adjust itself instantly to rapidly changing conditions. Indeed it may frequently happen that millions of dollars worth of property, scores of human lives, and its own safety, may depend upon its ability to move and turn in terms of seconds.

When it comes to agility, an electrically-propelled vessel can far surpass any other type. Consider the possibilities of a boat with twin propellers, and each propeller driven by a separate motor. It is entirely practical to place, either in the pilot house or on the bridge, two controllers (one for the starboard propeller and the other for the port) which control directly the operation of the motors.

When the handle of one controller is moved in the "ahead" direction, the corresponding motor starts up, at first slowly and then with constantly increasing speed as the movement of the handle is continued, until full speed is reached. Bringing the handle back to "stop," stops the motor; while moving the handle in the "astern" direction reverses the motor in a similar manner. In the extreme "astern" position of the handle, full speed and full power astern is obtained. Any number of speed steps can be provided in each direction; the propeller speed will remain constant on any step until the handle is again moved; and the change from full speed ahead to full speed astern can be made in 5 seconds or less.

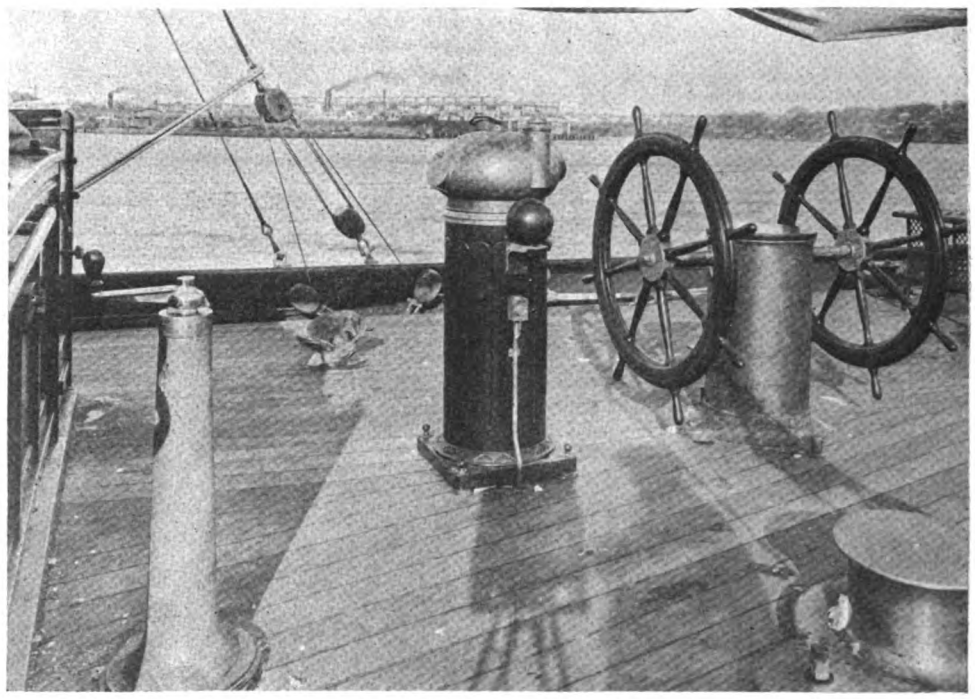
Since by operating the propellers, the boat can be handled much more rapidly and delicately than by using the rudder in the usual manner, it is evident that the control of the boat can be placed literally at the finger tips of a man on the deck, who, without the loss of a second, can manoeuver in any desired manner and whirl the boat around as if on a pivot by merely moving the controller handles.

No boats have as yet been equipped in the manner described, but the practicability of the principle is demonstrated by the little vessel "Elfay," which has a Diesel-electric auxiliary engine. This yacht, which has a single propeller, is controlled from the deck by a controller resembling the familiar trolley-car type. Moving the handle of this controller around to the left starts the propeller motor in the ahead direction and gradually brings it up to full speed. Turning the handle to the right reverses the motor in a similar manner.

The "Elfay" has been in active service about a year and has proved thoroughly successful. She is equippd with a 115-H.P. Winton Diesel-engine of 425 R. P. M. which is directly connected to a 75-Kw Westinghouse direct-current generator of 125 volts. The propelling motor is a 90 H.P. Westinghouse machine with a speed range of from 0 to 350 R. P. M. A 9-Kw generator is also driven from the main engine to supply electric power for energizing the fields of the main generator and motor and also for lighting and power purposes.

The exact details of a Diesel-electric equipment to be used on a given fire-boat will, of course, depend entirely upon circumstances, but it seems probable that the following arrangement will be more or less closely followed.

The boat will have two propellers, each to be driven by a direct-current motor. There will be two main propelling units, which are duplicates, and each will consist of a Diesel engine direct-connected to a direct-current generator. Either unit will provide sufficient power to operate the boat at about 75% full speed, while both will be used for full speed. The motors will be controlled from two stations, one in the engine room and the other in the pilot house or on the bridge.



Deck controller of the "Elfay." Operation of the propeller is under control of the navigating officers

The fire pumps are to be operated by electric motors, supplied with power from one or more Diesel-engine-generator sets, which are to have the same characteristics as the propelling units; and connections are to be so arranged that power from any generator can be used, when desired, for either the pump-motors or the propeller-motors.

*With the Westinghouse Electric & Mfg. Co.

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# British Admiralty Experiments with Diesel Engines

## *A Technical Article of Particular Interest to Engine Builders*

By Engineer-Commander C. J. HAWKES, R. N.

Part II.

(*Continued from page* 827, *Sept.*, 1920)

The first point considered during the preliminary design stage, after fixing the cylinder diameter, etc., was the type of framing to be adopted. After full consideration of the various types it was decided, having in view stiffness of structure as well as weight, to adopt the steel column principle—the casting being of box form. For a multi-cylinder engine this framing should prove both rigid and comparatively light. Although it was intended that the framing for a multi-cylinder engine should be of cast-steel it was decided, in order to get quick delivery and to keep down the cost, to make the framing of the single cylinder of cast-iron—the scantlings being slightly increased over those necessary with steel. It may be mentioned that, with the exception of the moving parts, cylinder cover, fuel-valve and a few minor fittings, parts which were intended to be made of aluminium or cast-steel in a complete engine were in this instance made of cast-iron.

A water-cooled cast-steel sandwich-plate, carrying the liner, is secured to the top of the column and the cast-steel cylinder head is in turn fitted to the sandwich plate—the studs for securing the head passing through the sandwich plate to the column. The liner now in use is made of close-grained cast iron, but liners of special steel will be fitted for experiment later. At the lower end

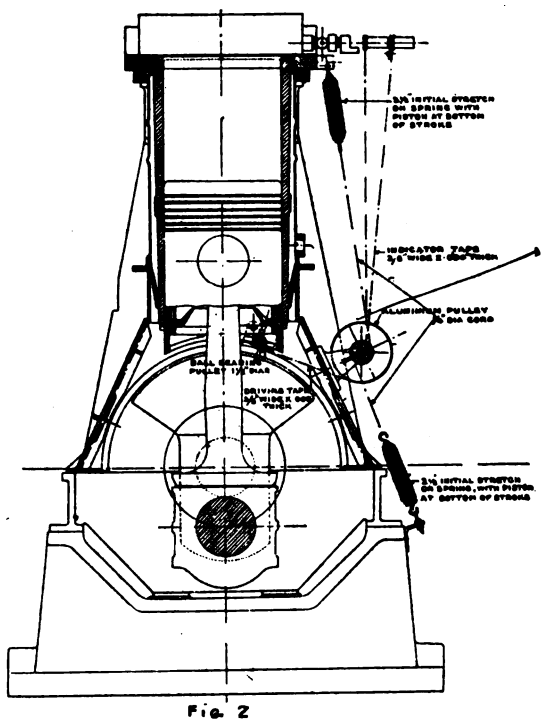

FIG. 2

ARRANGEMENT OF INDICATOR GEAR

of the liner the water-joint with the thin sheet-steel water-jacket is made by rubber-rings in the usual way. The upper part of the water-jacket is housed in the sandwich-plate in such a manner that the pitch of the cover studs is reduced to a minimum.

The bedplate is of cast-iron arranged for convenience to embody the lubricating-oil pump. The lubricating-oil pump, driven by an eccentric on an extension of the crank-shaft and housed within the crank-chamber, is of the Brotherhood valveless type. The crank-shaft is of ordinary 30 to 35 ton steel and is fitted with cast-steel balance-weights, lead filled. The connecting-rod is of I-section, of 30 to 35 tons steels, with the corners of the palm end cut away, and to suit the piston-cooling gear the length between centres was made 4.9 cranks. The large-end bearing is of cast-steel, filled with white-metal. The hollow gudgeon-pin, of Ubas steel, is shrunk into the connecting-rod.

The aluminium-alloy piston closely followed the design adopted for the "Unit" engine previously described. In view of the results obtained with the "Unit" piston it was thought that the 20 in. piston would probably run satisfactorily without any special means of cooling. As there was a doubt about this it was decided to arrange for oil cooling, and the system adopted followed the lines of that fitted by Messrs. Sulzer Frérès. A separate motor-driven pump and cooler are provided for the piston-cooling oil.

The recess in the head of the piston is hemispherical. There were two reasons for this, viz., that the hemispherical recess resulted in a combustion-chamber of good form which would probably facilitate combustion and also that by adopting this shape in the design of an experimental engine it enabled pistons having heads of other shapes to be fitted for experiment at a later date, if considered necessary, without any structural alterations. The adoption of this shape of piston-head adds several inches to the over-all height of the engine but it is considered that it is justified—especially in the case of an experimental engine.

The cast-steel cylinder-head was made as simple and as light as possible, consistent with stiffness, and care was taken to avoid, where possible, all straight ribbing. Air and exhaust passages are not embodied in the cover. The fuel-valve housing, which is amply cooled, connects the top and bottom flanges of the cover and completely surrounds the fuel-valve casing. The housing for the air and exhaust-valve boxes, which form curved ribs between the top and bottom flanges of the cover, do not completely surround the valve-boxes so that the latter are directly in contact with the cooling-water. Four large cleaning-doors are provided in the sides of the cover. By this design a comparatively simple casting is obtained and, although a considerably reduced depth of cover results from the air and exhaust valve passages not being embodied in the casting, so far as can be seen the cover is stiff enough for all practical purposes—in fact it may be definitely stated that even when working at high speeds and high mean-pressures it is at least as stiff as the cast-steel covers fitted to the standard submarine engines and which have given practically no trouble on Service. Cooling water enters the jacket at two points and passes into the cover and the exhaust-valve box. The sandwich-plate is separately cooled.

It was considered from the point of view of quiet running that helical gears were preferable to spur or bevel drives, so were therefore adopted and as it was desired to arrange for an enclosed cam-case, and at the same time to be in a position to remove the cylinder-cover without dismantling the valve actuating-gear, push-rods. It may be mentioned that this gear is very quiet in operation.

The air and exhaust valve-boxes, which in the experimental engine are of cast-iron, are in two parts—the lower parts having respectively the inlet and exhaust ports cast in them and the upper parts or spring-boxes carrying the fulcrum-brackets. The air and exhaust valve-boxes are secured to the cylinder-cover by three studs—copper rings being used for making the joints. Since this gear was designed a slight rearrangement has been made which results in reducing the head-room required by about 6 in. The exhaust valve and box are water-cooled. The air and exhaust valves are of nickel steel and the cams of steel, hardened and ground.

In high-speed engines it is considered advisable that provisions should be made for readily adjusting the timing of the fuel-valves—as is adopted in the Vicker's standard engines. In the case of the experimental engine, in order that the timing

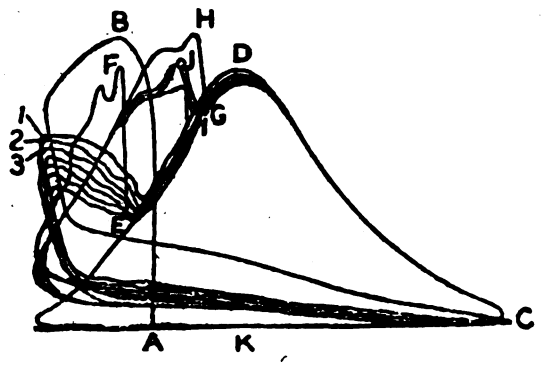


FIG. 8.

of the fuel valve can be varied slightly, the fuel-cam is mounted on a slideable boss. By the use of helical splines the position of the fuel-cam in relation to the cam-shaft can be altered within the limits of movement of the slideable boss by means of a small hand wheel connected to the slideable boss by a system of levers and rods.

It was the original intention to fit a special-fuel valve to the experimental engine but, owing to delay in connection with other experiments, it was decided to utilize for the preliminary tests a fuel valve which did not differ in any marked degree from the ordinary air injection type.

The fuel-pump is of the ordinary Diesel type but it is designed to deal with pressures up to 6,000 lbs. per square inch so that "solid" injection can be employed at a later date if desired. The quantity of fuel pumped is regulated by means of the fuel-pump suction-valve in the usual manner, through suitable levers connected to the manœuvring gear. The operation of starting, etc., is very similar to that adopted in many other engines and requires no special description. There is a mechanically operated starting control valve and an automatic starting-valve on the cylinder head—the water-cooled box containing the automatic valve being also utilized for accommodating the relief-valve and indicator connection, so that only one hole in the cover is necessary for these fittings. A Ruston standard governor is fitted on the vertical shaft and arranged to cut off the fuel supply when the engine reaches a speed of about 420 R.P.M.

The fulcrums for the compound fuel valve actuating levers are carried by a separate casting secured to the cylinder-cover—so that there is no fulcrum-bracket attached to the fuel-valve casing. When the fuel supply is altered the lift of the fuel-valve is also modified slightly.

A cast-steel flywheel, giving a cyclic irregularity of about 1/35, is fitted so that a high peripheral

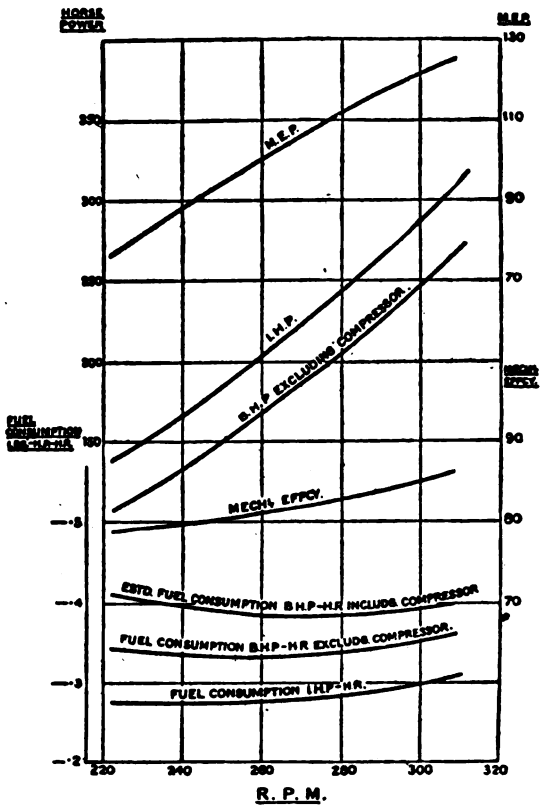


FIG. 7.

speed can be safely employed. Forced lubrication is employed throughout. The cylinder liner and exhaust valve spindle are lubricated by a mechanical lubricator.

The indicator gear is of similar design to that already described, and, following the practice adopted in the case of other engines, separate gears are fitted for taking combustion and fuel-valve lift diagrams. It was originally intended that the air-compressor should be driven by the engine but it was eventually decided, in view of future work, to drive it independently. The power developed by the engine is absorbed by a Heenan & Froude dynamometer. Other points in connection with this engine require no special reference.

The engine was first started on fuel on 28th October of last year and short runs were made, using Texas fuel-oil at 250 R.P.M., the maximum compression pressure with a compression ratio of 13.15 being 475 lbs. per square inch. During these runs no oil was used for cooling the piston. When the piston was examined it was found to be in excellent condition and it showed an even bed on the liner and it was therefore replaced. The speed and power of the engine were then gradually increased to 350 R.P.M. and 200 B.H.P. There were no mechanical difficulties at this speed, but it was found that the resistance in the fuel-valve to the passage of air and fuel was

(*Continued on page* 1001)

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(*Continued from page* 998)

too great and a number of pulverizer-washers were consequently removed. This modification enabled 168 B.H.P. to be developed at 300 R.P.M., but the quantity of pulverizing-air used was still insufficient—in fact the fuel-valve was working as a very inefficient solid-injection valve—and the fuel-consumption was 0.6 lb. per B.H.P.-hour.

The fuel-valve of this engine, as in the case of the air-injection valve fitted to the engine previously described, was provided with a distributor containing a large number of small holes so that the air-sprays corresponding to each hole could be directed into the combustion-chamber in any predetermined direction. This is essential for engines running at high-speeds and with comparatively high mean pressures, and it is interesting to note that the fuel-valves of the German submarine-engines are fitted with multiple-hole distributors and other firms have also recently adopted this as standard practice.

In view of the resistance in the fuel-valve of the experimental engine it was decided to remove all the pulverizer-washers and to replace the distributor by one having a small number of larger holes, as it was desired to limit the pressure of the blast-air to 1,000 lbs. per square-inch when the engine was developing its full output. This alteration resulted in 168 B.H.P. being developed at 300 R.P.M. with a fuel-consumption of 0.35 lb. per B.H.P.-hour—a marked improvement on the result previously obtained. This figure for consumption does not include the power required to drive the air-compressor.

At this stage the revolutions of the engine had to be limited to 300 R.P.M., and the running generally was considerably restricted owing to complaints in regard to vibration. On a few occasions, however, before the speed was limited the engine had been run at its rated speed with no signs of trouble. It might be mentioned that while the balance-weights attached to the cranks reduce the magnitude of the vertical unbalanced forces, they introduce a horizontal couple in the athwartship plane, and as the centre-line of the engine is, on account of the lay-out of the laboratory, unavoidably 11 ft. from the ground level, the rocking of the engine at high speeds was fairly marked.

As 300 R.P.M. could not be exceeded, although a few tests were actually run at about 320 R.P.M. after this time, it was decided to carry out tests at about this speed and at lower speeds with the object of improving the fuel-consumption. Typical results obtained are shown in Table III.

The power required to supply the blast-air is not accounted for in columns 3, 6 and 10. The compressor used is of the Reavell type driven by belt from an electric motor. Column 8 gives the horse-powers absorbed by the compressor after making the necessary deductions from the E.H.P., based on a combined motor and belt efficiency of 85 per cent. The speed of the electric-motor can be varied slightly, but beyond this the air delivered in excess of requirements is blown off between the first and second stages. Owing to the design of the compressor it is not possible, as is done in the case of the other experimental engines, accurately to measure the quantity of blast-air actually used by the engine when it is running. By noting, however, the time required to pump-up the bottles over small ranges of pressure when the compressor is running at the same speeds, etc., as during the tests an approximation can be obtained of the air used, and therefore of the power required to supply this air. It was found that in all cases the powers given in column 8, Table III., exceeded those calculated from the figures obtained for the quantity of air pumped. It was considered desirable, however, to take the higher figures, i.e., those shown in column 8, for estimating the fuel-consumption per B.H.P. *including* the compressor—shown in column 11, Table III., but it may be pointed out that in the author's opinion these results are slightly higher than would be obtained if the compressor were driven by the engine and definite fuel consumptions obtained for the net B.H.P. developed. These remarks apply also to the figures given in Table IV.

As already mentioned, the figures given are typical of the results obtained for many tests with distributors having various numbers, sizes and angles of holes, and for convenience they are shown graphically in Fig. 7. The fuel used during all these tests was Texas fuel-oil, having a specific gravity of 0.92 at 60° F. The exhaust during these tests was smokeless, but it was found when running at higher mean pressures, just above 130 lbs. per square inch, the exhaust became slightly shaded.

A number of tests, many of from 2 to 6 hours' duration, were also carried out at about 300 R.P.M., with mean indicated pressures of about 150 lbs. per square inch and with various distributors—the object being further to test the piston. The exhaust during these tests was shaded. The particulars given in Table IV. are typical of the results obtained. (See Sept. issue.)

At the end of 100 hours running at various powers, the engine was opened out for inspection, and the piston, top-end and bottom-end bearings were found to be in excellent condition. The engine runs smoothly and well at the higher speeds. At the lower powers a very slight piston knock is sometimes noticeable, which would indicate that the piston clearance is slightly greater than necessary at these speeds. There is no knock, however, at the higher powers.

The quantity of piston-cooling oil circulated through the system when running at 314 B.H.P. at 314 R.P.M. was only 210 gallons per hour—the rise in temperature of the cooling-oil being 64° F. If we assume, therefore, that the calorific-value of the oil is 18,400 B.Th.U.'s (lower heating value), the quantity of heat carried away by the cooling oil is about 2.3 per cent of the heat supplied. At lower speeds, and also at lower mean pressures at the same speed, the percentage of heat passing to the cooling oil is slightly higher. It would probably be advisable to pass a larger quantity of oil through the piston and reduce the rise in temperature.

Further tests are, of course, proceeding, and later it will be possible to continue the tests at the higher speeds. So far no mechanical difficulties have been encountered, and it is not anticipated that any trouble will arise which will prevent the engine developing at least the rated net B.H.P., i.e., the B.H.P. arrived at after making full allowance for the power required to drive the air compressor.

By running an engine at high mean-pressures a greater power can be developed in a given space and the weight per B.H.P. is reduced. It is well known that many makers of marine oil-engines are of the opinion that it is unwise to work with mean indicated pressures much in excess of 100 lbs. per square inch—in fact, the present tendency seems to be to reduce this figure. This is no doubt the result of past experience, and may be desirable in the case of merchant-ship engines. The requirements of a naval engine, however, differ considerably from those of a merchant engine, and it is felt that if progress is to be made with naval engines the use of higher mean-pressures should be seriously considered. In all the experiments which have been carried out at the Admiralty Engineering Laboratory, therefore, the adoption of high mean-pressures has always been kept in mind. It was for this reason that the experimental engine just referred to was designed with a rated mean indicated-pressure of about 120 lbs. per square inch.

No difficulty has been experienced at the laboratory in running high-speed Diesel engines working on the four-stroke or two-stroke opposed-piston cycles, at 130 lbs. M.E.P. with a smokeless exhaust when using Texas fuel-oil, but in each case air-injection has been necessary, as smokeless combustion has not so far been obtained with the solid injection system at mean-pressures much in excess of 100 lbs. per square inch.

For pressures above 130 los. per square-inch it is probable that supercharging will be adopted, and the problem of working at these high mean-pressures with a smokeless exhaust is primarily one of successful fuel-injection—in fact, the fuel-injection valve is the heart of the high-speed engine.

At present it is usual to work with a compression ratio as low as possible and to obtain economy by introducing the fuel-oil before the top dead centre. This results in a rise of pressure at (approximately) the dead centre, which in the case of the Laboratory experiments has so far been limited to 630 lbs. per square-inch. The introduction of supercharging air would result in a high compression-pressure with the same compression ratio, and consequently, if it were desired to work with the same limiting maximum pressure after injection, the fuel would have to be injected later. This, apart from other considerations, would result in a slightly higher fuel-consumption per horse-power.

The greater charge-weight of air in the working-cylinder when supercharged should enable more fuel to be satisfactorily burned, resulting in a higher mean-pressure. The temperatures throughout the cycle when working at high mean-pressures with supercharging in use would not necessarily be higher than when working with lower mean-pressures without supercharging—i.e. temperature difficulties would not be increased as a result of the adoption of supercharging. The supercharging engine would be slightly more complicated and additional air-pumps would be necessary, which would slightly reduce the mechanical efficiency of the engine; but these pumps would have to deal only with comparativiely low pressures. It may be taken that if 50 per cent more power was developed by supercharging, approximately 10 per cent would be absorbed in supplying the supercharging air, i.e. there would be a net gain in power of 40 per cent.

A low fuel-consumption is not the only desideratum for naval engines, and it is considered, therefore, that supercharging experiments are fully justified, and the 300 B.H.P. experimental engine already described will be modified for this purpose at a later date. In this instance air will be drawn through the inlet valve in the ordinary way, and the supercharging air will be introduced through ports in the liner towards the end of the suction stroke of the piston. The air will be supplied by a rotary blower, and arrangements made so that the blower can be cut out when the supercharging air is not required.

(*To be continued in our Dec. issue*)

TABLE III

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| Test No. | R. P. M. | B. H. P. | I. P. H. | M. E. P. | Mechanical Efficiency, Per cent. | Blast Pressure, Lbs. per sq. in. | H. P. of Compressor. | Fuel Consumption. Lbs. per h. p. hour. I. H. P. | B. H. P. excluding Compressor. | B. H. P. including Compressor (estimated). |
| 28 | 309 | 268 | 310 | 126 | 86.4 | 960 | 27.3 | 0.31 | 0.36 | 0.4 |
| 30 | 282 | 212 | 254 | 114 | 83.5 | 960 | 27.3 | 0.28 | 0.34 | 0.39 |
| 31 | 262 | 173 | 207 | 100 | 83.6 | 880 | 23.2 | 0.28 | 0.33 | 0.38 |
| 49 | 245 | 138 | 174 | 90 | 79.4 | 750 | 18.2 | 0.28 | 0.35 | 0.4 |
| 50 | 222 | 106 | 135 | 76 | 78.5 | 700 | 17.3 | 0.27 | 0.34 | 0.41 |

TABLE IV

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| Test No. | R. P. M. | B. H. P. | I. H. P. | M. E. P. | Mechanical Efficiency, Per cent. | Blast Pressure. Lbs. per sq. in. | H. P. of Compressor. | Fuel Consumption. Lbs. per h. p. hour. I. H. P. | B. H. P. excluding Compressor. | B. H. P. including Compressor (estimated). |
| 24 | 314 | 314 | 373 | 150 | 84.1 | 1,000 | 24.7 | 0.39 | 0.46 | 0.53 |
| 25 | 313 | 313 | 358 | 144 | 87.4 | 1,000 | 26.7 | 0.37 | 0.42 | 0.46 |
| 57 | 288 | 288 | 344 | 150 | 84.4 | 990 | 23.3 | 0.33 | 0.39 | 0.43 |
| 63 | 284 | 284 | 322 | 143 | 88.2 | 1,000 | 28.2 | 0.32 | 0.36 | 0.4 |
| 65 | 283 | 283 | 334 | 149 | 84.7 | 1,000 | 27.8 | 0.33 | 0.39 | 0.43 |

## SIX DAYS' ENGINE TEST

### 140 *Hours' Trial of Schneider Engine of* 1,450 *Shaft H.P.*

AN acceptance test of 140 hours in the shop with a later trial of 24 hours at sea, formed conditions in a contract which Schneider & Co., of Le Creusot, France, accepted from one of the European Navies. We have been privileged to publish extracts from the official log of this endurance test. The engine is of the two-stroke reversible type with eight cylinders of 410 m/m diameter (16.14 ins.) and with a piston stroke of 450 m/m (17.71 inches) turning at 330 revs. per min. developing about 1450 Shaft H.P. at that speed. The main trial, consisting of 140 hours operation at 8/10ths full load, was begun on the 20th of February and completed on the 26th under the supervision of the engineers of the Navy in question. The starting-air was opened up at 11:27 A. M. on Feb. 20th without any pre-heating of the engine and the load was gradually increased during the succeeding half hour. The official time for the start of the test was six minutes after mid-day.

For six consecutive days and nights the load was maintained as nearly constant as possible, without the least hitch in the operation of the motor. Readings of temperature and of pressure, together with indicator diagrams, afforded a complete record of the perfect running of the engine. Owing to the automatic character of the lubrication and the well-designed arrangement of all mechanism, the operation of the engine required only a very small staff. The adjustments made at the start remained practically undisturbed during the entire test. The injection-air pressure, however, had to be slightly increased towards the end of the trial, in order to maintain the proper degree of atomization of the fuel.

After the engine had been shut down about 8 A.M. on Feb. 26th, it was subjected to a number of maneuvering tests devised to demonstrate the reversing capabilities of the design. All these operations were carried out with the utmost facil-

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# 1450 B.H.P. NAVAL DIESEL ENGINE
## Schneider Two-Stroke

Official Endurance Test of 140 hours at 8–10th full-load

### STARBOARD ENGINE

Surrounding Temperature
Min. 50 °F
Max. 69 °F

Atmospheric Pressure
Min. 28 98 ins. at 64 °F
Max. 29 36 ins. at 68 °F

| Date | Log. time | RPM | Air Pressure | | Oil Pressure | | Temperatures Oil | | | | Circulating Water | | Circulating Water Pressure | Weight on Brake Beam | Power absorbed by the BRAKE X | Circulating Pumps Power to be Subtracted | | Available B.H.P. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lubrication | | Cooling | | | | | | | Water | Oil | |
| | | | Injection | Scavenging | Lubrication at Exit from Strainer | Cooling at Exit from Cooler | Before Cooling | After Cooling | Before Cooling | After Cooling | Suction | Discharge | | | | | | |
| | | | lbs/▽" | lbs/▽" | lbs/▽" | lbs/▽" | °F | °F | °F | °F | °F | °F | lbs/▽" | lbs. | X | Y | Z | |
| | | | | | | | | | | | | | | | B.H.P. | B.H.P. | B.H.P. | B.H.P. |
| 2–20–18 | 12.6 P.M. | Start | 832 | 5,55 | 12,80 | 19,20 | 115 | 98 | 183 | 127 | 45 | 82 | 7,11 | 2028 | 1144,63 | 5,65 | 3,80 | 1135,18 |
| | 6.45 P.M. | 298,6 | | | | | | | | | | | | | | | | |
| 2–21–18 | 12,45 A.M. | 299,7 | 853 | 5,55 | 12,80 | 19,20 | 115 | 99 | 181 | 124 | 45 | 80 | 7.82 | 2030 | 1150,09 | 5,28 | 3,78 | 1141,03 |
| | 6,45 A.M. | 300,4 | 853 | 5,55 | 12,80 | 19,20 | 114 | 99 | 183 | 127 | 45 | 80 | 7,11 | 2028 | 1151,53 | 4,93 | 3,74 | 1142,86 |
| | 12,45 P.M. | 299,2 | 860 | 5,62 | 12,80 | 19,91 | 115 | 101 | 181 | 127 | 45 | 80 | 7,11 | 2061 | 1165,63 | 5,10 | 3,78 | 1156,75 |
| | 6,45 P.M. | 299,7 | 868 | 5,62 | 12,80 | 19,20 | 116 | 104 | 183 | 127 | 45 | 80 | 7,82 | 2050 | 1161,34 | 5,47 | 3,64 | 1152,23 |
| 2–22–18 | 12,45 A.M. | 299,6 | 868 | 5,62 | 12,80 | 17,72 | 116 | 103 | 183 | 127 | 45 | 80 | 7,82 | 2052 | 1162,18 | 5,24 | 3,46 | 1153,48 |
| | 6,45 A.M. | 297,8 | 882 | 5,62 | 12,80 | 19,20 | 115 | 102 | 183 | 129 | 45 | 80 | 7,82 | 2061 | 1160,13 | 5,01 | 3,72 | 1151,40 |
| | 12,45 P.M. | 300,1 | 903 | 5,62 | 12,80 | 19,91 | 116 | 103 | 183 | 131 | 45 | 80 | 7,11 | 2081 | 1161,63 | 5,10 | 3,70 | 1152,83 |
| | 6,45 P.M. | 298,6 | 882 | 5,55 | 12,80 | 18,49 | 117 | 102 | 183 | 129 | 43 | 81 | 8,15 | 2050 | 1157,07 | 5,15 | 3,58 | 1148,34 |
| 2–23–18 | 12,45 A.M. | 298,9 | 896 | 5,55 | 12,80 | 19,49 | 118 | 104 | 183 | 129 | 43 | 82 | 8,15 | 2050 | 1158,24 | 5,24 | 3,73 | 1149,27 |
| | 6,45 A.M. | 298,5 | 910 | 5,55 | 12,94 | 19,20 | 118 | 102 | 185 | 128 | 43 | 83 | 7,11 | 2059 | 1161,66 | 5,06 | 3,66 | 1152,94 |
| | 12,45 P.M. | 298,2 | 896 | 5,55 | 12,80 | 19,91 | 117 | 100 | 184 | 132 | 43 | 84 | 7,82 | 2061 | 1161,73 | 5,15 | 3,73 | 1152,85 |
| | 6,45 P.M. | 298,4 | 903 | 5,55 | 12,80 | 18,49 | 117 | 97 | 185 | 131 | 45 | 84 | 7,76 | 2050 | 1156,30 | 5,15 | 3,82 | 1147,33 |
| 2–24–18 | 12,45 A.M. | 299,4 | 903 | 5,55 | 12,94 | 18,49 | 118 | 100 | 185 | 131 | 45 | 83 | 7,11 | 2054 | 1162,67 | 5,28 | 3,64 | 1153,75 |
| | 6,45 A.M. | 300 | 896 | 5,55 | 13,51 | 18,49 | 117 | 101 | 184 | 129 | 43 | 82 | 8,15 | 2048 | 1160 | 5,15 | 3,37 | 1151,48 |
| | 12,45 P.M. | 299 | 896 | 5,48 | 13,16 | 19,75 | 117 | 100 | 184 | 131 | 43 | 82 | 7,11 | 2046 | 1154,89 | 5,10 | 3,70 | 1146,09 |
| | 6,45 P.M. | 301,9 | 917 | 5,40 | 12,80 | 18,91 | 115 | 91 | 186 | 129 | 43 | 78 | 9,25 | 2028 | 1157,28 | 5,19 | 3,43 | 1148,66 |
| 2–25–18 | 12.45 A.M. | 298,2 | 925 | 5,40 | 12,80 | 18,49 | 119 | 101 | 187 | 138 | 43 | 80 | 8,53 | 2046 | 1151,79 | 5,28 | 3,52 | 1142,99 |
| | 6,45 A.M. | 299,1 | 939 | 5,55 | 13,09 | 18,49 | 119 | 101 | 187 | 131 | 45 | 80 | 9,25 | 2052 | 1160,25 | 5,33 | 3,46 | 1151,46 |
| | 12,45 P.M. | 297,4 | 917 | 5,55 | 12,80 | 18,49 | 117 | 99 | 189 | 134 | 45 | 83 | 8,53 | 2041 | 1147,46 | 5,42 | 3,61 | 1138,43 |
| | 6,45 P.M. | 301 | 917 | 5,55 | 13,51 | 18,49 | 117 | 100 | 185 | 131 | 45 | 82 | 8,53 | 2050 | 1166,37 | 5,47 | 3,64 | 1157,26 |
| 2–26–18 | 12,45 A.M. | 300,7 | 932 | 5,55 | 13,51 | 19,20 | 118 | 101 | 186 | 131 | 45 | 82 | 8,53 | 2059 | 1170,22 | 5,47 | 3,46 | 1161,29 |
| | 6,45 A.M. | 299,5 | 932 | 5,55 | 13,51 | 17,72 | 118 | 99 | 185 | 129 | 45 | 79 | 8,53 | 2081 | 1159,31 | 5,47 | 3,46 | 1150,38 |
| | 8,6 A.M. | End | ... | .... | ..... | ..... | ... | ... | ... | ... | .. | .. | .... | .... | ..... | .... | .... | ..... |

ity and responsiveness. The engine was then immediately taken down and the parts submitted to the inspection of the Navy's engineers. They found no evidence of any noticeable wear. In particular, the pressure surfaces of the pistons and of the cylinders showed a perfect polish, thus demonstrating the efficiency of the lubrication.

At a later date when the engine had been installed in the submarine it was subjected to a trial of 24 hours at the same load under marine conditions. *The port engine went through the same trial with equal satisfaction.*

Hereunder we append data taken from the official reports and also diagrams taken at the start of the six day trial, on the third day and at the finish respectively. These diagrams are characteristic of a high-speed engine and show very satisfactory control of the combustion.

### RESULTS OF TEST

| | | |
|---|---|---|
| Mean revolutions per minute (by engine counter) | | 299.2 |
| Mean brake-horse-power at test speeds | | 1157.05 |
| Mean brake-horse-power, referred to 305 R. P. M. | | 1179.41 |
| Mean power absorbed by water circulating-pump (electrically driven) | | 5.27 |
| Mean power absorbed by oil circulating-pump (electrically driven) | | 3.66 |
| Mean available brake-horse-power at test speeds | | 1148.12 |
| Mean available brake-horse-power, referred to 305 R. P. M | | 1170.48 |
| Consumption | Fuel per B. H. P. hour during 8 hours trial (18,900 B. T. U. heat value) lb. | 0.478 |
| | Lubricating oil per hour (during entire 140 hours' test) lbs. | 10.93 |

### SUMMARY OF TRIAL CONDITIONS

The engine was started on the 20th February at 11.27 a. m. and stopped on the 26th February at 8.06 a. m.
The trial was started on the 20th February at 12.06 p. m. and finished on the 26th February at 8.06 a. m.
Readings were taken every hour during the trial (the table shows readings only every six hours).
The brake-horse-power readings were taken every hour on a Froude dynamometer.
Indicator diagrams were taken every five hours, with a simultaneous reading of the engine speed.
The amount of fuel serving as a basis for fuel-consumption figures was measured during eight consecutive hours on February 21st.
The fuel used was Navy kerosene with a specific gravity of 0.801 at 50 degrees F.
The amount of lubricating oil was measured throughout the trial.
The lubricating oil used had a specific gravity of 0.898 at 67 degrees F.
The power absorbed by the electrically driven circulating pumps was calculated from the ammeter and volmeter readings.

### ANOTHER SWEDISH MOTORSHIP

"Scania," a new motorship of 1,000 tons d.w.c., has been launched by the Linhamn Shipyard, Stockholm, to the order of the Swedish Lloyd and a sister motor-vessel is to be laid-down immediately. For propelling power she has a 500 b.h.p. Polar two-cycle type Diesel engine and a speed of 10 knots fully loaded is expected.

### WARSHIP TO MERCHANT MOTORSHIP

The German twin-screw warship "Gefion," has been converted into a Diesel-driven motorship of 2600 tons and re-named "Adolf Sommerfeld." The "Gefion," was built in 1893 by the Schichav yard and had a displacement of 3770 tons. Her dimensions are as follows:

| | |
|---|---|
| Length | 358 ft, 3 ins. |
| Breadth | 43 ft. 4 ins. |
| Draught | 21 ft. 6 ins. |
| Power | 9,000 i.h.p. |
| Speed | 18 knots |

The work of converting her into a motorship has been carried out by the Danzig Shipbuilding Co.

### MORE DIESEL-ELECTRIC TRAWLERS TO BE BUILT

A Diesel-electric trawler is proposed to be built for the Lybeck Ocean Harvester Co., Inc., 140 W. Forsythe St., Jacksonville, Fla., who have New York offices at 134 West Thirty-fourth Street. We understand that Winton Diesel-engines may be the power installed in this fishing vessel.





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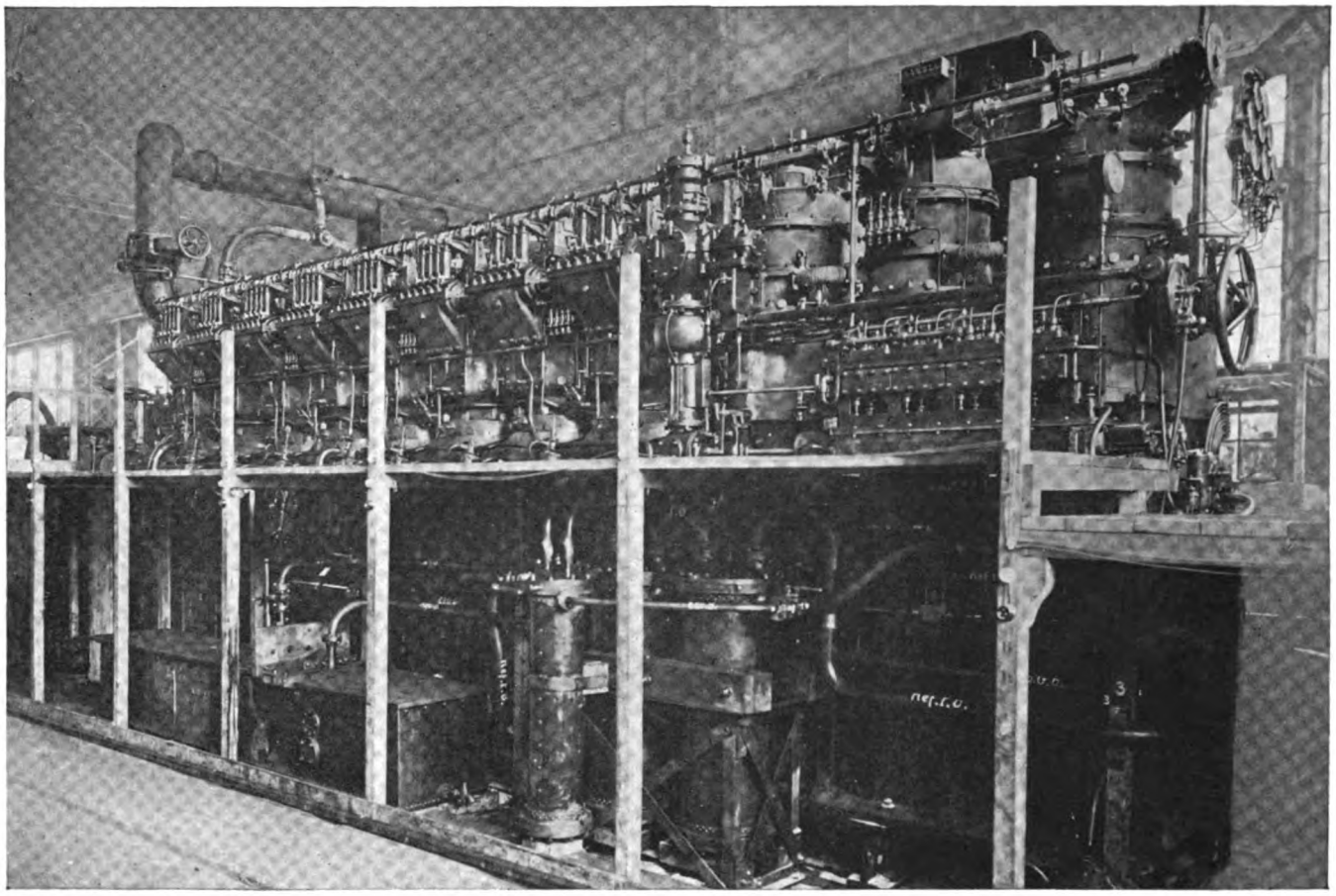

Schneider 1450 shaft h.p. naval Diesel engine on test. A complete description and drawings appeared in our issue of June, 1918

# Diesel and Diesel-Electric Drive for Freighters

## *Questions of Weight and Propeller Efficiency Compared with Steam Drive, from a Shipbuilder's Point of View*

By DR. ING. CARL COMMENTZ,
BLUMENTHAL, GERMANY

WHEN Diesel-engines were first used for the propulsion of ocean-going freighters, there were three facts made popular by their builders among shipowners. (1) The economy of the new engine as to fuel consumption. (2) The reduced weight. (3) The lower first-cost as compared with steam-engines. The Diesel-engine was claimed to be superior in every item. Specially, the fuel-consumption proved to be much smaller. To get a fair comparison with the steam-engine in this respect, caution must be taken, as sometimes figures are given, which do not allow minute judgment.

In the first two or three years after the introduction of the Diesel-engine as a ship's propelling medium there was sometimes given the oil-consumption per brake-horsepower, i. e. the power with the consumption of coal per indicated horsepower of the steam-engine. This, of course, is a false base, as in the Diesel-engine there is lost about 20 to 25% of the indicated power in the engine herself, while in the marine steam-engine only 12 to 18% is lost. Therefore, later on, the fuel-consumption per brake-horsepower, i. e. the power transmitted by the crankshaft of the engine to the propeller shafting was made the criterion with Diesel-engines, and compared with the corresponding coal-consumption of steam-engines. This comparison is still very often made. The base of comparison, however, is still a false one.

The first Diesel-engine in large ships had a revolution-speed about twice that of reciprocating steam-engines. There were some reasons for this fact. The Diesel-engine was in its evolution and the units up to then constructed were only small. To get the power required for ocean-going ships, the total power had not only to be divided into two parts and twin-screws to be used, but also a high number of revolutions was necessary; for naturally a fast-running engine develops more power than a slow-turning one of the same dimensions.

Of course, weight and first-cost were considerably influenced by the high number of revolutions, and it is only for this reason that the new engine could compare favorably with the steam-engine as to weight and first cost. Most Diesel-engines, and especially those first used for ships, are of the single-acting four-stroke type; while the steam-engine is of the "double-acting two-stroke" type, which means that with the same cylinder-pressure the power of a steam engine of same dimensions and number of revolutions should be about four times as great as that of a similar Diesel-engine. Therefore, the weight of pistons, cylinders, crankshafts and similar parts of a Diesel-engine should be four times as great as that of a steam-engine of the same power.

Moreover, the pressure in the Diesel cylinder is much greater and of an explosive kind, while it is even in the steam-engine cylinder. Also the auxiliary engines of Diesel-driven ships are much heavier than those of steamships.

Though Diesel-engined ships have no steam boilers, at least not for the main engine, the mentioned conditions are the reason, that the *weight of Diesel-engines of the four-stroke type is about* 120-140% *of that of steam-engines, if the same number of revolutions be used.* Two-stroke Diesel engines compare more favorably, as their weight is about two-thirds of that of the four-stroke type. The actual weight of Diesel-engines, it must be admitted, is much smaller because their number of revolutions is in general up to this date, about 50% greater than that used with steam-engines in similar plants. There is no doubt, that it would be considerably higher than with steam-engines, if the same number of revolutions were used for the latter.

Now, weight and costs of steam-engines might equally be reduced without reduction of the fuel-consumption per indicated horsepower by increasing the number of revolutions. This, however, has not been done in practical cases with regard to the efficiency of the propeller. For each ship there is a certain diameter and pitch of propeller which gives the maximum efficiency. *For general freighters the number of revolutions belonging to the most effective propeller is from* 70 *to* 90 *per minute;* it differs with the size and speed of the ship. *By increasing the number of revolutions beyond the most effective a considerable loss of power is incurred;* this means that the same ship needs for the same speed a considerably greater power, if the number of revolutions is increased. So the total consumption of fuel will be greater, though the fuel consumption per horsepower is the same.

This is the reason why steam freighters are built with a number of revolutions between 70 and 90. These facts, there is no doubt whatever, apply equally to the Diesel-engine driven ship as to the steamship. There is only one little difference. The fuel-consumption is, especially on long voyages, of influence on the cargo carrying-capacity of the ship. As the fuel-consumption of Diesel engines is only about one-third of that of steam-engines, this influence on the freight-earning capacity is much smaller with motorships and therefore, a certain waste of fuel is of less consequence, at least as the cargo-carrying capacity is concerned.

But, the leading point of view in the question of fuel-consumption is the cost of fuel and this is on the same base with steam and oil-engines. *All facts considered, in my opinion the most economic number of revolutions of Diesel engines may in certain cases be about* 5-10% *higher than that of steam-engines, but never more.*

To investigate the influence of number of revolutions on the weight of the engine and on the efficiency of the propeller, there are some points to be considered. The weight of steam-engines and of Diesel-engines is given by the weight of parts, which undergo certain stresses and by the weight of parts, which are not severely stressed. The parts, which are not severely stressed are; condensors, pumps, piping, water, floor-plates, tools and part of the auxiliary engines. The weight of these parts is about one-third to one-fourth of the total weight; it is proportionate to the power of the engine and is not influenced by the number of revolutions. The weight of the stressed parts, i. e. about two-thirds of the total weight is decreased in proportion as the numbers of revolutions is increased. This, of course, with the Diesel-engine concerns two-thirds of the total plant, with steam-engines only about one-third of the total plant, as the weight of the boilers is not influenced by the number of revolutions. This fact also is a reason why Diesel-engine manufacturers like to take high number of revolutions, for they know that thereby the weights and first costs are considerably reduced.

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TABLE I

# DIESEL-ELECTRIC DRIVE FOR FREIGHTERS*

D. D. D.=DIESEL DIRECT DRIVE.
D. E. D.=DIESEL-ELECTRC DRIVE.
D. E. G. D.=DIESEL-ELECTRIC DRIVE WITH TOOTHED GEARING.

| | D. D. D. | D. E. D. | D. E. G. D. | D. D. D. | D. E. D. | D. E. G. D. | D. D. D. | D. E. D. | D. E. G. D. |
|---|---|---|---|---|---|---|---|---|---|
| Shaft horsepower at propeller shaft | 2500 | 2425 | 2425 | 3000 | 2880 | 2940 | 1500 | 1615 | 1615 |
| Number of revolutions at propeller | 117 | 90 | 90 | 110 | 80 | 80 | 110 | 100 | 100 |
| Relative efficiency of propeller | 0,95 | 1,00 | 1,00 | 0,94 | 1,00 | 1,00 | 0,98 | 1,00 | 1,00 |
| Number of propellers | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Relative efficiency of propulsion | 0,93 | 1.00 | 1.00 | 0,93 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Efficiency of electrical and tooth gearing combined | 1.00 | 0,91 | 0,89 | 1.00 | 0,91 | 0,89 | 1,00 | 0,91 | 0,89 |
| Total relative efficiency of drive | 1.00 | 1,03 | 1,008 | 1.00 | 1,04 | 1,018 | 1.00 | 0,929 | 0,909 |
| Brake horsepower of Diesel engines | 2500 | 2425 | 2480 | 3000 | 2880 | 2940 | 1500 | 1615 | 1650 |
| Number of Diesel engines | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| Number of revolutions of Diesel engines | 117 | 250 | 250 | 110 | 250 | 250 | 110 | 250 | 250 |
| WEIGHTS IN LBS: | | | | | | | | | |
| Diesel engines per b. h. p | 364 | 210 | 210 | 364 | 210 | 210 | 364 | 210 | 210 |
| Diesel engines (total) | 914,000 | 512,000 | 521,000 | 1,092,000 | 605,000 | 618,000 | 547,000 | 338,000 | 346,000 |
| Electrical generators | ..... | 88,200 | 90,000 | ..... | 106,000 | 108,000 | ..... | 59,500 | 61,000 |
| Electromotors and tooth gearing | ..... | 162,000 | 54,800 | ..... | 191,000 | 65,000 | ..... | 107,000 | 36,500 |
| Control gear | ..... | 53,000 | 55,000 | ..... | 64,000 | 65,000 | ..... | 37,500 | 38,500 |
| Propeller shafting | ..... | 33,000 | 33,700 | 53,000 | 39,600 | 40,500 | 31,000 | 21,600 | 22,000 |
| Main engines total | 158,000 | 848,200 | 754,500 | 1,145,000 | 1,005,600 | 896,500 | 578,000 | 563,600 | 504,000 |
| Auxiliary Diesel generator | 68,000 | 68,000 | 68,000 | 74,500 | 74,500 | 74,500 | 59,500 | 59,500 | 59,500 |
| Total weight of engine plant | 1,026,000 | 916,200 | 822,500 | 1,219,500 | 1,080,100 | 971,000 | 637,500 | 623,100 | 563,500 |
| Relative weight of engines | 1.00 | 0,892 | 0,800 | 1,00 | 0,886 | 0,798 | 1,00 | 0,980 | 0,885 |
| FIRST COST, $ PER B. H. P. | | | | | | | | | |
| Diesel engines | 110 | 90 | 90 | 105 | 85 | 85 | 105 | 85 | 85 |
| Electrical equipment and tooth gearing | ..... | 36 | 24 | ..... | 34 | 22 | ..... | 34 | 22 |
| Propeller shafting | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Auxiliary Diesel generators | 9.5 | 9.5 | 9.5 | 8.5 | 8.5 | 8.5 | 13 | 13 | 13 |
| Total cost per b.h.p | 124.0 | 170.0 | 128.0 | 118.0 | 132.0 | 120.0 | 122.5 | 136.5 | 124.5 |
| Total cost of engine plant | $310,000 | $340,000 | $318,000 | $354,000 | $380,000 | $353,000 | $184,000 | $220,500 | $205,500 |
| Relative Total Cost | 1.00 | 1,095 | 1,025 | 1.00 | 1,07 | 0,995 | 1.00 | 1.20 | 1.12 |
| FUEL CONSUMPTION | | | | | | | | | |
| Main engines per hour—lbs | 2500 x 0,40 | 2425 x 0,40 | 2480 x 0,40 | 3000 x 0,40 | 2880 x 0,40 | 2940 x 0,40 | 1500 x 0,40 | 1615 x 0,40 | 1650 x 0,40 |
| Auxiliary engines per hour—lbs | 120 x 0,45 | 100 x 0,45 | 100 x 0,45 | 120 x 0,45 | 120 x 0,45 | 120 x 0,45 | 75 x 0,45 | 75 x 0,45 | 75 x 0,45 |
| Total consumption per day—tons | 11,20 | 10,88 | 11,11 | 13,44 | 12,94 | 13,18 | 6,78 | 7,29 | 7,44 |
| Relative fuel consumption | 1.00 | 0,970 | 0,992 | 1.00 | 0,963 | 0,980 | 1,00 | 1,072 | 1,097 |

*The values of the costs and some of the values of the weights are based on the corresponding figures published in the July 1920 issue of MOTORSHIP.

Now, what is the size of losses incurred by high number of propeller revolutions? Some investigations on this question have been made, all with the result that the efficiency of propellers is considerably reduced with the increasing number of revolutions; but as to the size of the loss the opinions of experts differ widely.

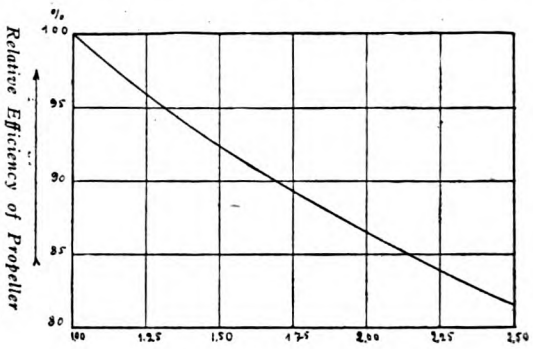
For instance, by doubling the number of revolutions one author gives a loss of efficiency of 11%, another of 16%, which makes a good difference. All investigations of theoretical and experimental kind considered, the loss of efficiency of the propeller will be about as follows:

| Increase of number of revolutions | 50% | 100% | 150% |
|---|---|---|---|
| Loss of propeller efficiency | 7.6% | 13.5% | 18.2% |

Intermediate values are given in the curve Fig. 1. These values shall be taken for the calculations following later on.

There is another question of propulsion connected with Diesel-engines. Most of the ocean-going motorships have twin-screws, because the units of the engines have not been built large enough to give the total power required. Twin-screws no doubt involve a loss of efficiency as compared with single screws. The single-screw of a freighter works in the wake of the ship and uses its power; twin-screws, sitting a certain distance from the center line of the ship, cannot utilize the power of the wake. The amount of loss of efficiency differs with size, form and speed of ships. With freighters of normal size and speed it is at least about 7%.

Regarding electrical-propulsion of freighters, the chief drawback is the loss of energy connected with it—it must be estimated at 8 to 10%. The second drawback is the weight and cost of the electric motor, both of which are considerable, if the regular normal number of revolutions of the propeller is used and if the electric motors are acting directly to the propeller shafting. There is one way of reducing weight and cost; namely, the use of tooth-gearing between the electro-motor and the propeller shafting. This, it is true, causes another loss of power of 2%. Which of the two




*Relative Revolutions of Propeller*

Fig. 1

arrangements, with or without gearing, is altogether the most economical depends upon the conditions of the special case, whether fuel-consumption or weight and first cost are of higher importance. The number of revolutions of Diesel-engined or Diesel-electric driven ships can be taken at about 250 per minute without in any way increasing the fuel-consumption. Diesel driven electric-generators of 250 revolutions may be built without difficulty up to about 2,000 brake horsepower. With Diesel-electric drive, no stronger auxiliary engines need be reckoned than with direct Diesel drive; the power necessary to excite the main engines as calculated in the efficinecy of the electric transmission given higher up with 90 to 92% and it is of no importance, whether the power for excitement is taken from the main engine or from an auxiliary generator.

*To get a fair comparison of the Diesel-electric drive with direct Diesel-drive, the most favorable arrangements for each type of plant must be made the base of comparison.* This has been tried in the following table No. 1, which has been worked for freighters of about 1500, 2500 and 3000 brake horse-power. With 1500 horse-power there needs to be only one unit of engine, whether with or without electrical transmission. In the two other cases, the power of the motors has to be divided into two units, which with electrical transmission drive only one screw. The number of revolutions of the directly driven propellers is about 25 to 35% higher than that of the ships with electrical transmission, which have the same number of revolutions as similar steam-engines; this is much less than in most actual motorships, where in general as mentioned above, it is about 50% greater than with steam-engines.

There is one most striking feature in the results of the calculations: The gains effectuated by the electrical transmission are of very small

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consequence in the case of the small ship, where there is only one screw in the direct drive. The cost and fuel-consumption are even considerably higher, only the weight is 2 to 12% lower. But with the two other ships the effect is quite a different one. The fuel-consumption is smaller, the weight is considerably less and only the cost is greater. Altogether there is one certain conclusion; *Electrical transmission in Diesel-engined ships' drive is favorable, if it serves to add the generating power of two or more Diesel engines and brings all power to one propeller.* This fact is very remarkable, as in most big ocean-going motor-freighters, it has been necessary to separate the power and to use twin screws with two Diesel motors.

To have a broader base for the aforesaid sentence, some more investigations of similar kind have been made, including some Diesel engines of different number of revolutions for direct-drive.

In the first years of motorshipping, shipowners had a certain feeling of security in the fact that the motorships generally had two engines, some breakdowns occurred but the ships were not helpless. The safety of Diesel motors is much better to-day. The electric transmission has no liability of breakdowns in itself; the safety of the Diesel generators is still better than with reversible engines. It is probable that with Diesel-electric drive, the electro-motors will have their place at the end of the ship, in this case, there will be no shaft-tunnel and the cargo-rooms behind the engine-room will be without obstruction and straight. Moreover, there is a certain easiness in electrical ships drive, good control of manoeuvring, full-power astern, because the number of revolutions is slow and the big screw acts powerfully against the stream of water. These factors though not to be calculated in numbers, must not be overlooked.

TABLE II

| | | | | | |
|---|---|---|---|---|---|
| **Ship of about 1500 b.h.p.** | | D.D.D. | | D.E.D. | D.E.G.D. |
| Number of Diesel engines | 1 | 1 | 1 | 1 | 1 |
| Number of propellers | 1 | 1 | 1 | 1 | 1 |
| Relative number of revolutions of propeller | 1.50 | 1.30 | 1.10 | 1.00 | 1.00 |
| Relative weight of engine plant | **0.914** | 1.00 | 1.12 | 1.10 | **0.991** |
| Relative cost of engine plant | **0.92** | 1.00 | 1.115 | 1.345 | 1.252 |
| Relative total fuel consumption | 1.031 | 1.00 | **0.979** | 1.044 | 1.067 |
| **Ship of about 2500 b.h.p.** | | D.D.D. | | D.E.D. | D.E.G.D. |
| Number of Diesel engines | 2 | 2 | 2 | 2 | 2 |
| Number of propellers | 2 | 2 | 2 | 2 | 2 |
| Relative number of revolutions of propeller | 1.50 | 1.30 | 1.10 | 1.00 | 1.00 |
| Relative weight of engine plant | **0.914** | 1.00 | 1.12 | **0.893** | **0.802** |
| Relative cost of engine plant | **0.920** | 1.00 | 1.115 | 1.096 | 1.027 |
| Relative total fuel consumption | 1.032 | 1.00 | **0.978** | **0.970** | **0.990** |
| **Ship of about 3000 b.h.p.** | | D.D.D. | | D.E.D. | D.E.G.D. |
| Number of Diesel engines | 2 | 2 | 2 | 2 | 2 |
| Number of propellers | 2 | 2 | 2 | 2 | 2 |
| Relative number of revolutions of propeller | 1.50 | 1.30 | 1.10 | 1.00 | 1.00 |
| Relative weight of engine plant | **0.914** | 1.00 | 1.12 | **0.867** | **0.772** |
| Relative cost of engine plant | **0.92** | 1.00 | 1.115 | 1.056 | **0.987** |
| Relative total fuel consumption | 1.033 | 1.00 | **0.977** | **0.968** | **0.989** |
| **Ship of about 4000 b.h.p.** | | D.D.D. | | D.E.D. | D.E.G.D. |
| Number of Diesel engines | 2 | 2 | 2 | 2 | 2 |
| Number of propellers | 2 | 2 | 2 | 2 | 2 |
| Relative number of revolutions of propeller | 1.50 | 1.30 | 1.10 | 1.00 | 1.00 |
| Relative weight of engine plant | **0.914** | 1.00 | 1.12 | **0.840** | **0.790** |
| Relative cost of engine plant | **0.92** | 1.00 | 1.115 | 1.022 | **0.945** |
| Relative total fuel consumption | 1.033 | 1.00 | **0.977** | **0.966** | **0.987** |

The results of these investigations are given in Table No. 2.

In this table, there are given the relative values for a fast running direct-driving Diesel engine, for one of intermediate velocity and for a slow-running one of the same kind; they are compared with Diesel electric-drive with and without tooth gearing. The number of revolutions of propeller of the plants with electrical transmission is the same as used with steam-engines. The number of revolutions with direct-drive is 10, 30 and 50% more, that is, the number which should be aimed at for reasons of economy, further the number which will be used in the near future and the number used generally until now. The unit for all values is that of the engine with 130% of normal propeller revolutions; it has been made the base of comparison, because it is the engine of to-morrow and because a fair comparison can only be made with the most economic engine possible; the slow running engine will come, there is no doubt, but not so very soon, because until now it is not powerful enough for ships drive and for its considerable weight.

The costs are higher than with the intermediate Diesel engine if no tooth gearing is used; with gearing, the plant is cheaper. The costs are, however, smaller than those of the slow-running Diesel engine. There is no doubt that *fuel consumption is of paramount influence in the total calculation of a ship's economy and from this point of view, electrical-transmission compares favorably if there are two Diesel generators but one screw-propeller.* Therefore, the field of the electric drive is, where it can replace double screws by one screw. This field is still large enough and includes all big freighters, to say nothing of intermediate freight and passenger boats.

There are some minor questions combined with electric drive. The generating engines are much smaller than with direct drive. Generally the number of cylinders and pistons can be reduced and by consequence the consumption of lubrication-oil is smaller and so are the costs for upkeep and engine-room staff. The costs for lubricating up-keep and watching the electrical power-transmission engines are much smaller than the difference of these costs for slow running directly driving Diesel motors and for fast running Diesel-driven generators. Further, the Diesel generators are not of the reversible type, as reversing is done by the electrical parts of the power transmission.

## EDITORIAL COMMENTS

[There are many interesting arguments and claims raised in the foregoing article, and the author holds the same views as many steamship men who have not had the fullest opportunity to study Diesel-driven motorship operation in all its aspects. Therefore, we have given space to the foregoing contribution in order that readers may be fully acquainted with the actual conditions as well as the theoretical arguments.

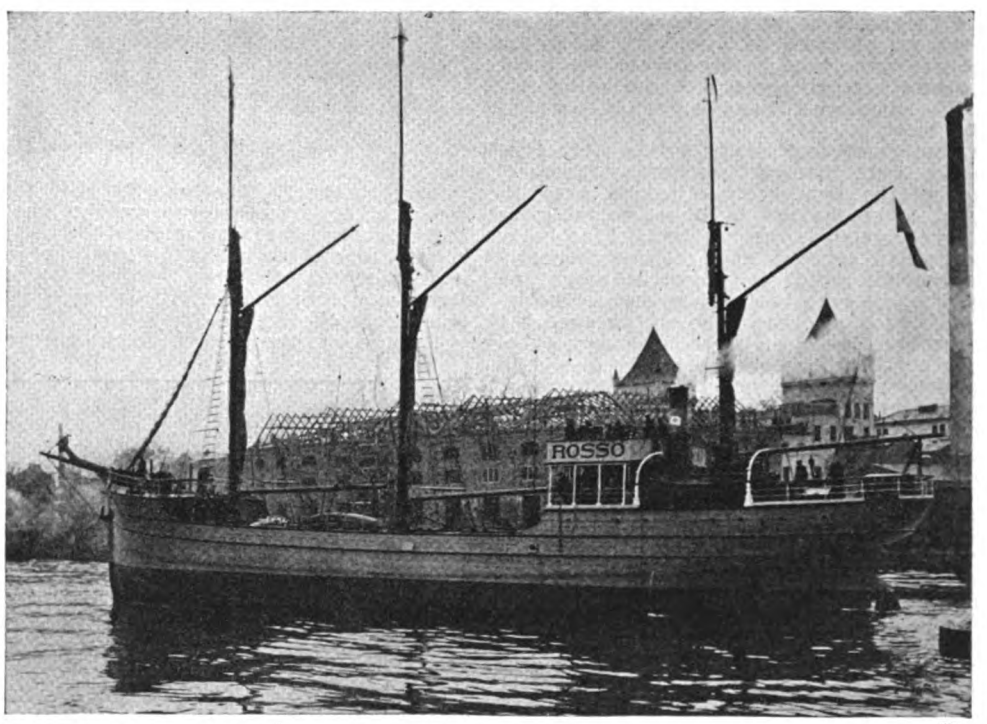
Dr. Commentz claims that single-screw drive is more efficient generally than the twin-screw. Naval architects of the modern school, however, are coming to the belief that the twin-screw system by reason of the propellers, being more deeply immersed and by reason of being free from the obstruction of the flow of water by the stern frame of the ship, receive more solid water; hence, have reduced slip and in consequence are more efficient than a single-screw at lower speed. This particularly applies in the case of motorships.

There is another factor which Dr. Commentz has entirely overlooked; but which has important bearing on the question. That is, the absence of racing with a twin-screw Diesel-engine drive. The latter feature is partly due to the fact that immediately the propellers start to move at a speed beyond 10 to 12% of the rated revolutions, the governor acting on the fuel-injection pumps instantly functions and momentarily cuts-off the fuel, with the result that the engine is virtually dead for a very brief period. There is only the momentum of the flywheel and other reciprocating parts to keep the propeller moving until the speed has dropped sufficiently for the governor to be cut-out and the fuel-injection pumps to have commenced working again. This does not apply to steam-engines because of the presence of steam in the chambers between the cylinders.

The second reason is that the twin-screws being smaller and placed lower in the hull are normally more deeply immersed in the water and do not lift-out except in unusually rough weather, particularly when the vessel is loaded. Even when the twin-screw motorship has no cargo, propeller racing is virtually non-existent with a well-designed job. In consequence, thro' the absence of racing the propeller efficiency of the twin-screw motorship on a round voyage is generally higher than the efficiency of the slow-turning propellers of a single-screw reciprocating steam-engined vessel—particularly on routes where a ship makes a voyage loaded one way and returns in ballast, as in the case of a bulk oil-carrying tankship or an ore-carrier.

We have known cases where this has resulted to the benefit of an average of half-a-knot to one-knot speed over a trans-atlantic voyage —particularly in winter time when seas often are continuously rough for weeks on end.

Incidentally, Dr. Commentz has omitted to refer to the propeller revolutions of the very latest type of steamship drive; namely, that of the geared-turbine in which the speeds are generally around 90 to 100 revolutions. Some engine builders are designing their Diesel engines to run as low as 75 revolutions per minute—others believe in speeds as high as 140 r. p. m. These seem to be the two extremes and a figure half-way between, to our mind, is a very reasonable speed in powers from 1,000 to 3,000 shaft h. p. allowing, of course, a little variation in accordance with particular features of the design of an engine. By adopting a medium speed the weights of the engine can be arranged so that there is a saving over the weights of steam-machinery, if we take the boilers, water-in-boilers, boiler-water in tanks and the condensers into consideration.—*Editor.*




**An interesting type of auxiliary-schooner. She is powered with a 240 b.h.p. Bergsunds oil-engine although of only 600 tons d.w.c.—An example of sensible power.**

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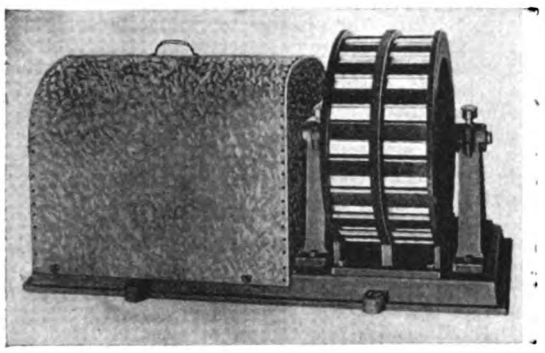
# Equipment For Oil-Engined Ships

### A SPECIAL SIREN FOR MOTORSHIPS

Many modern motorships in service and now building, entirely dispense with steam, even for heating, so there is nothing available for the siren but compressed-air. As a ship uses her siren the most when entering or leaving harbors and in fogs, it is during these periods that she most needs her supply of compressed-air for manoeuvring. Furthermore, a blast from an air siren gives no indication to the navigators of other ships as to what vessel is signalling, as they look for the white puff of steam, and, of course, the air-blast is invisible. Consequently it is very advisable to install a siren of an unusual type that will attract special attention from other ships and cause their navigators to look for an unusual type of vessel. Then they will at once realize that the signal came from the strange-looking ship—namely, the motorship, which often is without a smokestack. Thereby danger of collisions will be avoided. At night a combination of an electric flash might be used in conjunction with an electric-siren's blast.

A siren which fits in with the requirements of motorships—as they always have plenty of available electric-current, is the Denver Electric siren, which it may be remembered is installed on the Texas Steamship Company's motorship "Solitaire" with most satisfactory results.

The Denver siren consists essentially of two parts—a stator and a rotor. The stator is of cast-iron bolted to the cast-iron sub-base, which also



The Denver Siren

carries a spacing block upon which is mounted the driving motor. The rotor is of aluminum, very light in weight and carefully balanced for the speed at which it is to run. The rotor is carried on babbitted bearings, lined up true and bolted to the base. Both stator and rotor are carefully machined, so that while, of course, the rotor runs close, there is no contact between the two elements. The rotor is connected by means of a leather-link flexible-coupling to the driving motor.

A General-Electric motor is furnished as part of the regular equipment. The motor is of the horsepower and speed best suited for the siren it is to drive, and with electrical characteristics to suit the user's power circuit.

As to the loudness of the tone produced, we regret to say that there is no way known to science to measure this, or to calculate how far it can be heard. Experience is and can be the only guide. We have heard it and can say it is a most powerful blast.

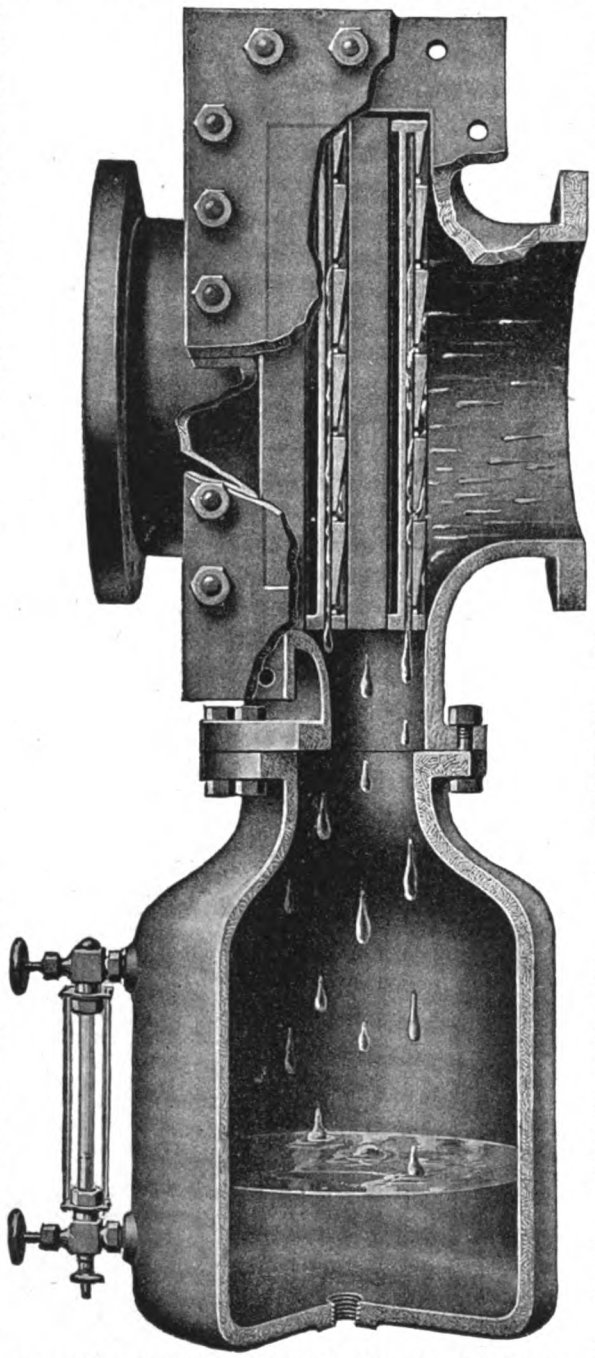
No motor-driven device built on the siren principle is, in itself, adapted for sounding "number" signals, but the Denver siren makers have developed a brake for use in those special cases where number signals are required. This brake is electrically operated and releases instantly when the motor switch is thrown in, permitting the siren to come up to speed at once. The instant the switch is opened, the spring applies a heavy braking force upon the wheel mounted on the siren shaft, bringing the machine to a dead stop in something under ten seconds. "Number" signals or any desired "code" may be sounded clearly and rapidly.

### SIMPLE OIL SEPARATOR FOR MOTORSHIP USE

To engineers of steamships the Bundy Oil Separator is known throughout the world's merchant-fleets and it is a remarkable fact that in spite of the years which have elapsed since this apparatus was designed, it has held its own and is today being adopted for the engine-rooms of the latest development—namely the motorship.

The accompanying illustration shows clearly the construction of this separator. Shell and baffle-plates are of cast-iron. These multiple baffle-plates are of special staggered-grid construction and are so designed as to insure the removal of all oil before it leaves the separator. The oil after being deposited on the saw-tooth grids, enters a duct inside of the grid-bars and flows through this duct to the large receiver reservoir at the bottom.

This separator fulfills one of the most important requirements of an efficient oil-separator. It is apparent that if an oil-separator is efficient that the separation cannot be accomplished without the baffle-plate surfaces becoming gummed with oil and grease and also that this coating reduces the separating efficiency. It is, therefore, essential that an oil-separator be so constructed as to



be easily cleaned. The baffle-plates in the Bundy separator are removable through an opening provided and may be taken out and cleaned in a lye solution and returned to the separator ready for another period of efficient service. We will mention that it is manufactured by the Griscom-Russell Co., 90 West Street, New York.

To prevent particles of oil which have been deposited on the plates from being picked-up again, the plates are so constructed that such deposited oil remains in contact with the steam used in the filtering only a short time. This is accomplished as follows. The side of the plate column against which the steam strikes has a saw tooth construction. Each column has a channel or duct cut through its center communicated with by the cups or sub-channels which are bored through from the front of the plate, one of these sub-channels being placed at the bottom of each saw-tooth. The particles of oil and water carried suspended with the steam-current will cling to the rough cast-iron surfaces of the columns and each drop will trickle down the surface of the particular saw tooth on which it has been deposited, will be caught in the cup at the base of the saw tooth, enter the interior channel and fall into the receiver provided.

If a plain column without the saw tooth interior channel construction were used, a particle of oil deposited on the upper surface of one of these columns would have to trickle down the entire height of the plate before it reached the receiver and there would be maximum danger of the oil being picked up again by the steam. This danger is minimized in the Bundy construction for the deposited drops of oil remain in contact with the steam only long enough for them to trickle down the heighth of one saw tooth.

### TWO FLEETS OF MOTOR-BARGES BUILDING

The fleet of oil-engined barges building for the Elder Dempster Co. of Liverpool, England, by J. Crichton & Co., Chester, will have the following dimensions:

| | |
|---|---|
| Deadweight capacity | 300 tons |
| Length | 124 ft. 0 in. |
| Breadth | 25 ft. 0 in. |
| Draught | 6 ft. 6 in. |

They will be fitted with a two-cylinder 90 b.h.p. Kromhout surface-ignition oil-engine turning at 300 r.p.m.

The same firm are building a fleet of eight twin-screw motor barges for J. Summers & Sons, Shotton, England. They are dimensioned as follows:

| | |
|---|---|
| Deadweight-capacity | 200 tons |
| Length | 126 ft. 0 in. |
| Breadth | 16 ft. 4 in. |
| Trial Speed First Boat | 7½ knots |

In each of these boats two 50 b.h.p. Bolinder oil-engines are being fitted.

### PETER AND PAUL

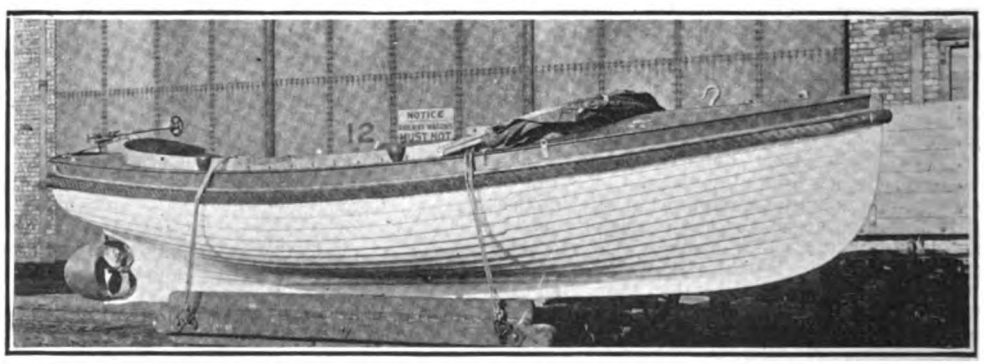
Some 10,400 tons oil-tankers are now being built on the Clyde for American owners under supervision and design of W. J. Douglas & Partners, Ltd. About the same time as these vessels were contracted for, a well-known British oil company placed an order for a number of tankers of somewhat similar size with shipbuilders on the Pacific Coast of the United States. In other words, "The English have come to America, and the Americans have gone to Great Britain," or the old story of Peter and Paul.

### NEW FRENCH SUBMARINES

The French Marine Ministry announce that the building of six submarines will be begun in 1921. The first four will be constructed at Cherbourg and the other two at Toulon.

### CANCELLING STEAMSHIP ORDERS IN GREAT BRITAIN

"The Shipbuilder," of Newcastle-on-Tyne, England, states that the "tendency to cancel orders for steamers on the Clyde will affect very little the orders for large motor-propelled vessels for cargo-carrying purposes, and that of such vessels there are far more in hand than is generally understood."



General service launch fitted with Kitchen reversing rudder, rights for which have been acquired by the McNab Co. of Bridgeport, Conn.

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# Oil and Motorships in 1920

## *The Present Oil Situation in Europe and Elsewhere*

BY W. H. BOTSFORD

GREAT BRITAIN has grown great on coal, the possession of coal near the seaboard, the development of an unequalled coal export trade, coaling stations all over the World, all these things are at the foundation of what was, British Maritime Supremacy.

Now the oil-age on the sea should belong to America, America with her newly built merchant fleet, with her oil-burning ships, her great crude-oil fields of Mexico and California, and the more recent Louisiana and Texas fields, then again the great Shale deposits in the Colorado Rockies as yet untouched, waiting for bold pioneers such as Rockefeller or Deterding. But when we find lack of Governmental co-ordination with our greatest private oil-concern the Standard Oil Co., left by itself, bereft of the great guiding hand of Mr. Rockefeller since 1914 split up into some thirty-three different fragments it represents a great but gradually declining force which may have difficulty in keeping its head above the new enterprise which is looming up on the horizon, the Royal Dutch Shell Co., with Mr. Deterding at the head; taking advantage of the Standard Oil dismemberment he has wrested from them the domination in China, now getting into his hands all extra American wells entering into the California, Oklahoma, and Mexico fields, building oil stations at either end of the Panama Canal, together with the largest refinery in the World at Curacoa.

The Royal Dutch Shell means British as well as Dutch capital; it owns or controls much of the oil producing territory of Roumania, Russia, Egypt, Mexico, Persia, South America and Central America. It controls the Roxana Petroleum Co., which owns in the Healdton District of Oklahoma 680 acres and in the famous Cushing District 300 acres, the policy of this great organization is reflected by the speech of President Runciman of the Board of Trade of Great Britain in the House of Commons in 1916, when he said "the future policy of Great Britain will not only be to control the coal of the World, but the supply of oil as well".

Now let us go into some detail as to English influence and genius South American fields. The most interesting and the most valuable of these centres around Roumania; Germany through the Deutsche Bank of Berlin had before the war extensive interests in this country; we hear from them that large oil-companies are being formed, notably, the Industrie Roumana de Petrol with a capital of 300,000,000 Lei (approximately £1,000,000) Petrolina with a capital of 25,000,000 (approximately £167,000) and the Neptune Co., with a capitalization of 15,000,000 Lei (approximately £100,000). In the first named only Roumanian money is interested, the other two however, are Companies in which English, French, and Belgian capital of the "Shell" group play the leading roles. We have also the Phoenix Oil and Transport Co., formed principally to acquire the assets and controlling interests in crude-oil producing and refining, undertakings, operating in Roumania to finance their development, and to transport and distribute the oil products. This Company takes over six established oil-companies in Roumania of which a fair portion are located in that rich section called Moreni.

But the largest of all recent undertakings in England that shed light upon the English policy enveloping Roumania, comes in the announcement of the formation of a group of British, French, and Roumanians, which will be known as the Steana-Roumana Co., they have acquired the Deutsche Banks 51% holdings in the Steana-Roumana Co., giving them control. The English group is headed by the Anglo-Persian Oil Co., and Messrs. Stern Brothers. The French have La Banque de Paris et des Pays-Bas, Mm. Maraband & Cie., La Societe d'etudes et d'entreprises, and finally Messieurs Mallet Freres et Cie. The Roumanian group is represented by La Banque Marmoresch, La Banque Romanesca, La Banque Generale, La Banque de Credit Roumain.

The Roumanian group participates in this purchase to the extent of 50.1% and the British and French groups are to get 24.95% each. The capital of this Company is Lei 100,000,000, 200,000 shares of 500 Lei each of these 100,002 Lei have been absorbed from the Deutsche Bank.

But to set off this big English stroke we had before the war, and still have the Romano-Americana, the Standard Oil undertaking in Roumania, and recently at a special meeting held at Bucharest the capital was increased from 37,500,000 Lei to 150,000,000 Lei with the authorization given to the Directors to raise this amount by a further 50,000,000 Lei making a total of 200,000,000 as against the English Companies 100,000,000 Lei.

We see then that America is still represented in the Roumanian fields, but we are far behind in acquiring new properties since the war, which is caused by the strict passport requirements, and the so-called Roumanian Government restrictions which do not allow foreigners to gain concessions in Roumania (by foreigners I mean Americans). As an example of how the Shell people are working—take the incident in Venzuela—confronted by the task of getting oil from the fields to the seaboard via the water route with the water depth not permitting anything but shallow-draft boats, the Shell interests purchased from the British Government a number of monitors and have refitted these into motor tankers with excellent results. It might be wise to show at this point some of the profits gathered during the last seven years, showing the strength of the Shell group particularly:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Shell Transport | 1913 | 35% | £4,082,000 | issued | Cap: | 1919 | 35% | £12,857,641 issued Cap: |
| Burmah | 1913 | 27½% | £1,905,000 | issued | Cap: | 1919 | 50% | 4 shares for every five. |
| Sobitos | 1913 | 15% | £399,992 | issued | Cap: | 1919 | 20% | |
| Mex: Eagle | 1913 | 8% | £4,150,000 | issued | Cap: | 1919 | 45% | £4,705,679 issued Cap: |
| Royal Dutch | 1913 | 43% | | | | 1919 | 45% | £17,818,000 issued Cap: |
| Anglo-Persian | 1913 | 6% | | | | 1919 | 10% | £3,000,000 issued Cap: |

England itself has practically no oil, only in Norfolk the properties of the English Oil-fields Ltd., their shale deposits yield a small amount, sufficient to care for the United Kingdom in case America ever puts an embargo on oil-exports to Great Britain

Some of the prominent men discussed the future of oil and Diesel-engines—Mr. W. A. White the Inventor of the White Fuel-oil system and who recently returned from a round trip on the "Olympic" believes that the Diesel-engined ships is the future ship's engine, and with the oil carried in double-bottom tanks an enormous saving in cargo space. On the other hand we have Sir Mackay Edgar of Sperling & Co. the Bankers, who as a prominent oil authority says that the transforming of the "Olympic" and "Aquitania" to oil-burners was a terrible blunder, and to use his own language—"It is the most improvident of all ways of using up the oil resources of the World." Of course, there are hundreds of others whose favorite pastime is to compare coal and oil and argue as to the relative value, but it would be impossible to quote them. Personally I believe the oil supply of the World to be practically inexhaustible, all that is necessary is to search for it. The by-products of crude-oil are valuable and no loss results as is the case with coal—some of the by-products being: all tars, creosote, blast-furnace oil; coke-oven oil, mond gas-tar, alcohol, and a variety of vegetable oils, it is seen that all of the above represent values for some purpose or other.

When the natural supply begins to dwindle, we can fall back upon the shale deposits of the Colorado Rockies, the newly discovered deposits along the valleys of the Mataganisi, Moose and Abbitibi Rivers of Northern Ontario, this shale yielding 3.9% Crude oil.

I am now going to pass from the business aspect of the oil industry to the technical side—Briefly Diesel engines.

Rudolf Diesel was for Germany what Robert Fulton was for America—the great value of this German's invention consists in that it reduces the consumption of fuel per unit output to less than 1/3rd of the quantity of oil-fuel consumed in steam engines and boilers for the same output. It will not be necessary for me to go into the many advantages of the Diesel engine—they are known to the readers of this report, but I will take up actual trials, comparisons between two and four cycle engines, I will show why it is necessary for the United States to wake up and build Diesel engines of a recognized standard.

The largest motorship in the World described and illustrated in the September issue of "Motorship" is owned by the Baltic-American Petroleum Import Co. of Danzig, and has just completed her maiden voyage from Hamburg to New York. She was built during the war by the Krupp people, and has a dead-weight tonnage of 17,000 tons with a speed actual of 11½ knots—she consumes only 12/14 tons of fuel per day and uses only 15 engine-room hands—just compare this with the engine and boiler room staff of a coal burner of equal tonnage!

Diesel engines are not expensive, they are but slightly more difficult to construct than steam engines, but as I have frequently heard American Chief-Engineers or Machine Shop Superintendents, or Foremen say on being asked why the construction of Diesel Engine was not enjoyed by them, invariably the answer was "why bother about these complicated Dutch contraptions, the old triple-expansion is good enough"—then again the foreman would say—"well the work is too accurate to be done on our lathes, planers, mills, shapers, etc."—that is untrue of course. I would answer for them—the reason they do not care to do the work is because it is human nature to enjoy easy things and leave the more difficult for the next fellow—But why are the English, German, and French alive to the value of the Diesel engine, but not our own shipbuilders? Simply because the big man in America is like his employee, asleep and willing to pass the buck!

To illustrate my point showing of the development of the motorship:

In 1910 there were only 2 oil-engined vessels aggregating 1000 B.H.P.

In 1916 there were 106 oil-engined vessels aggregating 100,000 B.H.P.

In 1906 the biggest motorship was 75 feet long.

In 1920 the biggest motorship is over 500 feet long.

Have we any such development in the steam-engined ship? Have we any enormous saving in our old Scotch or water-tube Boilers? Has cargo-space increased because of the advantages of coal? Have the Engine-room personnel diminished? No! the old steam engine is reliable, but like the old horse drawn shay, it must give way eventually; and it is going to give way to the Diesel engine.

[It was recently announced that the Standard Oil Company has been successful in forming an important French subsidary with Mons. Jules Cambon as president and with Messrs. A. C. Bedford and H. E. Bedford on the Board.—*Editor*]

### WHY INCREASED NUMBER OF MOTORSHIPS WILL IMPROVE BUNKER-OIL SITUATION

A New York firm of exporters advised us that they recently purchased a cargo of about 7,000 tons of coal c.i.f. France, the ship then lying at Baltimore loaded and apparently ready to sail. So the cargo was paid for and the papers delivered. Several weeks later frantic cables from France announcing the non-arrival of the ship caused investigations. It was found that the vessel was still lying at Baltimore awaiting bunker-oil, and she did not leave for 35 days after the papers were delivered.

Had the vessel in question been a Diesel-driven motorship she would have needed only one-third of the quantity of fuel required by the steamer. Everyone knows that a small quantity of fuel, whether coal or oil, is easier to obtain than a large quantity. In this manner, if America had a large fleet of motorships instead of oil-burning craft, the bunker-oil situation would be in a much easier condition.

### ANOTHER LARGE STEAMSHIP CONVERTED

Trials have been run at Stockholm with the new 5,300 tons d.w. motorship "Augusta" of the "Banco" Shipowning Company, the vessel having arrived from Hamburg, where she was re-built and had new Diesel oil-engines installed.

### "OUR READERS OPINIONS"

"Our readers Opinions" page has been held over this month owing to a drawing to illustrate a long letter from Sulzer-Frérés in answer to "Starboard Watch" not yet having arrived.

### ANNUAL REPORT OF LLOYDS REGISTER

According to the recently issued annual report of Lloyds Register of Shipping more than 150 sets of Diesel type marine-engines are now being built for motorships under Lloyds survey and about an equal quantity of other types of marine heavy-oil engines. Lloyds also refer to various modifications being made in some engines including the use of solid-injection; but the most notable change lies in the direction of using higher maximum cylinder-pressures which in few instances are as high as 550 pounds per square inch.

During the year covered by the report 28 new motorships with an aggregate tonnage of 79,805 tons gross were fitted with Diesel-engines.

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